Q
11
.S85X
NH

ISSN 0038-3872

SMITHSONIAN
SEP 03 2010
LIBRARIES

SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

BULLETIN

Volume 109 **Number 2**

BCAS-A109(2) 23–121 (2010) **August 2010**

SHOUT
SHARE
IT

Southern California Academy of Sciences

Founded 6 November 1891, incorporated 17 May 1907

© Southern California Academy of Sciences, 2010

OFFICERS

Jonathan Baskin, *President*
Ann Dalkey, *Vice-President*
Edith Reed, *Recording Secretary*
Daniel Guthrie, *Corresponding Secretary*
Ann Dalkey, *Treasurer*
Daniel J. Pondella, II, *Editor*
Brad R. Blood, *Past President*
John Roberts, *Past President*
Robert Grove, *Past President*
Daniel J. Pondella, II, *Past President*
John H. Dorsey, *Past President*

BOARD OF DIRECTORS

2008–2011	2009–2012	2010–2013
Jonathan Baskin	M. James Allen	Lisa Babilonia
Gordon Hendler	Sabrina Drill	Brad R. Blood
Andrea Murray	Lisa Gilbane	Ann Dalkey
John Roberts	Mark Helvey	Julienne Kalman
Gloria Takahashi	Russell DiFiori	Edith Read

Membership is open to scholars in the fields of natural and social sciences, and to any person interested in the advancement of science. Dues for membership, changes of address, and requests for missing numbers lost in shipment should be addressed to: Southern California Academy of Sciences, the Natural History Museum of Los Angeles County, Exposition Park, Los Angeles, California 90007-4000.

Professional Members $45.00
Student Members 25.00
Memberships in other categories are available on request.

Fellows: Elected by the Board of Directors for meritorious services.

The Bulletin is published three times each year by the Academy. Manuscripts for publication should be sent to the appropriate editor as explained in "Instructions for Authors" on the inside back cover of each number. All other communications should be addressed to the Southern California Academy of Sciences in care of the Natural History Museum of Los Angeles County, Exposition Park, Los Angeles, California 90007-4000.

Date of this issue 19 August 2010

This paper meets the requirements of ANSI/NISO Z39.48-1992 (Permanence of Paper).

The Southern California Academy of Sciences wishes to thank the following for their generous donations to the 2009–2010 - Contribution Campaign.

Gold Level - $500 to $999

MBC Applied Environmental Sciences
Anonymous
Daniel Guthrie

Silver Level - $200 to $499

Ann Dalkey
April P. Ford
James E. Doty

Bronze Level - $100–$199

Kim Anthony
Jonathan Baskin
Alfred Cook
Michael Curtis
Kenneth Gobalet
Michael Horn
Edward Kormondy
Gus McCarthy
John Roberts
Thomas P. Smith
Camm Swift
Ruth Wilson
Ralph Appy
Bayard Brattstrom
Crowe Family
John Dorsey
Peter and Betsy Haaker
David Huckaby
Susanne Lawrenz-Miller
Raul Rodriguez
Mark Roeder
Barry Snyder
Leila Williams
Danielle Zacherl

Contributor Level - up to $99

Anonymous
Gregor M. Cailliet
Robert Hamilton
Gordon Hender
Tim Mikel
Donald J. Reish
Allan Schoenherr
Glenn Stewart
Harry L. Fierstine
Kristin Berry
James L. Campbell
Scott Harris
Judy Lemus
Steven Murray
Louella R. Saul
Nancy Steele
Rick Ware
Robert Grove

Bull. Southern California Acad. Sci.
109(2), 2010, pp. 23–36
© Southern California Academy of Sciences, 2010

Notes on the Breeding Biology of the White-Throated Swift in Southern California

Charles T. Collins

Department of Biological Sciences, California State University, Long Beach, CA 90840, ccollins@csulb.edu

Abstract.—Reproductive activities of White-throated Swifts (*Aeronautes saxatalis*) were examined from 1997 to 2006 at two nest sites in a human-made structure in southern California. The start of egg-laying was from 27 April to 30 May and hatching of the first chick ranged from 21 May to 23 June; all chicks had fledged by late July, 42–43 days after hatching. The annual molt of adults began in early June and broadly overlapped with the chick-rearing period. Year to year adult survival was minimally 73.9% and nesting pairs showed strong mate and nest site fidelity; pairs reused nests up to five consecutive years. The composition of the arthropod food (insects and spiders) brought to nestlings was different in the periods 1997–2000 and 2001–2004 but prey size was similar in both periods. The onset of breeding was more varied from year to year than the start of the primary feather molt suggesting differing environmental stimuli for these important components of the annual cycle.

The White-throated Swift (*Aeronautes saxatalis*) is a widespread and familiar element of the southern California avifauna. Its staccato chattering vocalization often announces its presence, searching for aerial prey high overhead, long before visual contact is made. In recent decades, this swift has utilized human-made structures as buildings, bridges and highway overpasses for nesting and roosting (Collins and Johnson 1982; Ryan and Collins 2000). In so doing it has expanded its local range farther from its more traditional rocky cliff sites. Recent studies have documented the molt and weight pattern of desert-inhabiting White-throated Swifts (Marin 2003) and the diet and behavior of coastal birds (Rudalevige et al. 2003; Ryan and Collins 2003a, b, c). Still there remains a paucity of information about the reproductive biology of the species (Ryan and Collins 2000). This is in large part due to the inaccessibility of their nests in natural cliff sites; rock-quarrying techniques had to be employed by early collectors to obtain the first nest and eggs (Hanna 1917; Bradbury 1918). The utilization of human-made sites by these swifts holds promise of better access to breeding sites and the acquisition of more information on their reproductive activities. In Europe, breeding colonies of the Common Swift (*Apus apus*) (Lack 1956; Gory 1987; Kaiser 1992), Pallid Swift (*A. pallidus*)(Boano and Cucco 1989) and Alpine Swift (*Tachymarptis melba*) (Arn-Willi 1960), situated in human-made structures have provided the necessary access for detailed study. Until a similar colony of White-throated Swifts is established, data on their reproductive activities will be characterized, as in this study, by regrettably small sample sizes.

Methods

The data presented here are based on a 9-year study of White-throated Swifts nesting in a human-made highway overpass in Glendale, Los Angeles County, California (34° 11.16′ N. 118° 13.01′ W; elevation 361 m) between 1997 and 2006. The land-cover type

within 15 km of the study location is largely urban with some areas of chaparral, coastal scrub and montane hardwood forest (Davis et al. 1998). The swifts entered the nest sites through 12.3 cm diameter drainage holes located on the underside of the overpass. There were eight such holes in the overpass of which 5–7 appeared to be utilized each year by nesting swifts. This was determined by observation of adults entering/leaving holes, fecal material below the hole or hearing vocalizing nestlings within. Only a single pair of swifts utilized any given opening. Two of the holes were accessible from inside making detailed observations possible each year. This program of study included capture and banding of both adults and nestlings with numbered aluminum bands issued by the U. S. Geological Survey (Bird Banding Laboratory), as well as documentation of chick growth and diet as indicated by analysis of food boluses brought to nestlings; adult body weight and molt were also studied. Food boluses were stored in 70% ethyl alcohol for later examination. Prey sizes (head to abdomen length omitting antennae and caudal appendages) were measured to the nearest 0.1 mm using an ocular micrometer. Adults and nestlings were weighed with a Pesola spring balance to the nearest 0.1 g and flattened wing lengths measured with a stopped wing rule to the nearest 1.0 mm. Egg weights were obtained with a portable electronic balance to 0.01 g.

The molt of adult primary feathers was scored using a numerical system where each feather is given a value from 0 to 5 (Newton 1966). In swifts, primary molt is usually symmetrical so only the primaries of the right wing were scored in this study. An unmolted feather was scored as 0, a dropped or missing feather as 1, an emerging new pin feather < ½ regrown as 2, a new feather ½ to ¾ regrown and partially emerged from the sheathing as 3, a nearly fully (> ¾) regrown feather with only some sheathing at the base as 4, and a fully regrown new feather as 5. A maximum score for replacement of the 10 primaries would thus be 50. A molt score of 20 might be achieved by having primaries 1–3 new (15), the fourth primary ¾ regrown (3) and the fifth primary being present as a short new pin feather (2) and primaries 6–10 old and unmolted (0).

Results and Discussion

Adult Body Weight

Nine adult White-throated Swifts of unknown sex were captured and weighed on 19 occasions in June-July 1997–2006. The mean body weight was 32.5 g (SE = 0.54). This is similar to other data for this species (Table 1) including birds from both desert (Marin 2003) and coastal (Collins, in, Dunning 1993) areas of southern California. Individuals weighed on 2–5 occasions in different years varied in weight from −4.6 to +8.5 g (mean 2.64, SD = 2.53) or about 8.2% of the mean for a coastal population (Collins, in Dunning 1993). The greatest annual difference in body weight was from an individual which weighed 29.8 g on 13 July 2005 and 38.3 g on 15 June 2006. Seasonal variation in body weight of up to 28.7% between the highest and lowest values were reported for a desert

Table 1. Body weights of adult White-throated Swifts in southern California.

Mean weight (g)	SE	n	Range	Source
31.7	0.23	89	26.5–37.2	Marin 2003
32.1	0.55	20	27.8–36.0	Collins, in Dunning 1993
30.5	–	19	29.0–33.5	Bartholomew et al. 1957
32.5	0.54	19	29.0–38.5	this study

Fig. 1. Nest, eggs, and developing chicks of White-throated Swifts: a – eggs show spotting by ectoparasite excrement. b – 8–9 day old chicks with developing semiplume feathers seen as subcutaneous dots. c – 23–24 day old chicks with grey semiplumes partially overgrown by incoming contour feathers. d – 38–40 day old chick with sheathing still present at base of some dorsal contour feathers.

population of White-throated Swifts (Marin 2003). This is less than the variation recorded for some other species of swifts (Gladwin and Nau 1964; Naik and Naik 1966).

Nests and nest parasites

All of the White-throated Swift nests observed at this location were shallow saucers of plant material and feathers glued together with saliva (Figure 1a). A strip of cellophane was incorporated into one nest. All the material was presumably gathered on the wing; construction of the nests was not observed. Two nests measured 8 × 8 cm, and 9.4 × 9.4 cm rim to rim and were 2.5–2.8 cm deep. New nests used for the first time contained less material and were often nearly torn apart by the normal movements of older nestlings. Nests that survived and were re-used in subsequent years (up to 5 successive years) became more substantial with the addition of new material each year. At the mouth of one of the other ventilation holes a dead young swift was observed tangled in

string, presumably brought in by the adults as nesting material. A similar incident was reported previously at another location (Collins and Johnson 1982). These observations are in general agreement with earlier descriptions of White-throated Swift nests (Ryan and Collins 2000 and references therein).

Parasites

Infestations of mites (Acarina) and bedbugs (Cimicidae) were noted in varying intensities in different years. They were observed in substantial numbers on nests, eggs, and chicks in some years and nearly absent in others. These have been previously identified as *Mimenstathia aeronautou* (mites) and *Snyexenoderus comosus* (bedbugs) (Peterson et al 1980; Usinger 1996). Samples of the bedbugs collected in 2006 were tested at the USDA National Wildlife Research Center and all were negative for exposure to West Nile Virus (WNV; P. Oesterle, pers.com.). Samples of the feather louse *Dennyus bruneri*, endemic to White-throated Swifts (Carriker 1954), were collected from both adults and late stage nestlings.

Eggs and Clutch Size

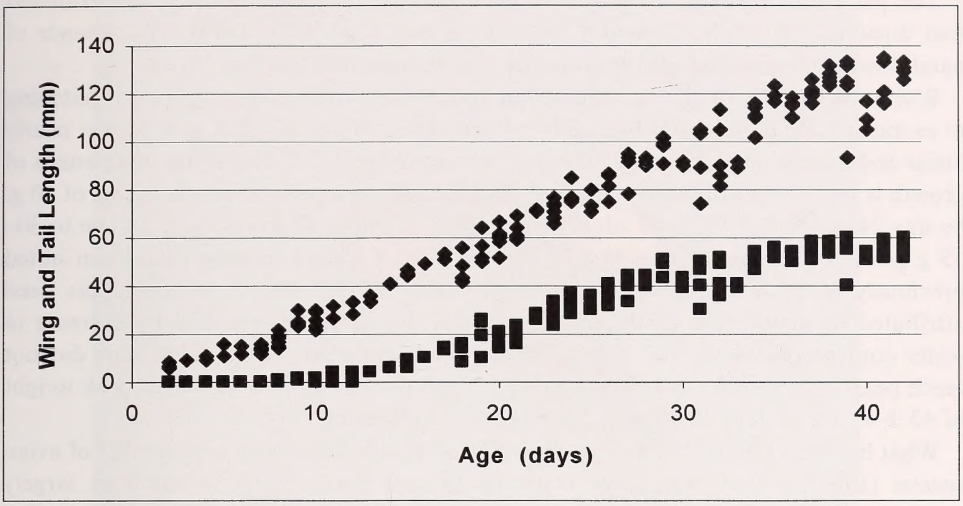
The eggs of the White-throated swift, like those of other swift species (Chantler 2000), were uniformly creamy white without gloss although they sometimes became spotted by excrement of ectoparasitic cimicids (Figure 1a). They showed little taper and have been described as varying from elongate ovate to cylindrical ovate (Bent 1940). In previous studies they have ranged in size from 18.6–22.6 × 12.9–14.7 mm (Ryan and Collins 2000). Twelve partially incubated eggs in this study weighed, on average, 1.95 g (SE = 0.04, range 1.7–2.2 g). Fresh egg weight of 27 eggs from southern California was 2.01 g (SE = 0.04) or 6.3% of adult weight (M. Marin, in Ryan and Collins 2000). Hatching success was 82% (14 of 17 eggs). Unhatched eggs remained in the nest for up to two weeks until they were eventually crushed or accidentally ejected.

Clutch size for four nests initially found with eggs was 4, 4, 4 and 5 eggs. Brood sizes in thirteen nests containing chicks when initially found ranged from 2 to 4, averaging 3.38 (SD =0.87). These values are in close agreement with previously recorded clutch sizes of 3–6 but normally 4–5 (Hanna 1917; Bradbury 1918; Bent 1940).

Chick Development

At hatching, White-throated Swift chicks were pink-skinned, devoid of any natal down, with eyes closed and a prominent egg-tooth. Their eyes were partially open by day 8–10 post hatching (Figure 1b) and fully open by day 15. The egg-tooth was still observable on day 8–9 but gone by day 18–19. The first feather coat was a covering of moderately long light grey down-like semiplumes. These were observable as subcutaneous dark dots by day 7–8 (Figure 1b) and erupted through the skin by day 11–13. The semiplumes were fully developed by day 20–23 but were covered over by the emerging contour feathers by day 28. The tracts of the body contour feathers were observable under the skin by day 11, and emerged through the skin by day 15. These pin feathers began to erupt through their sheaths by day 22–24 at which time they began to appear through the semiplume covering of the chicks (Figure 1c). The contour feathers appeared fully developed except for some remaining sheaths at their base by day 32–33; this sheathing was entirely gone by day 40 (Figure 1d). The primary flight feathers emerged through the skin on day 8–11 and started to erupt through the pin feather sheaths by day 15–18. They had emerged from the sheaths for half their length by day 23. The outermost

a.



b.

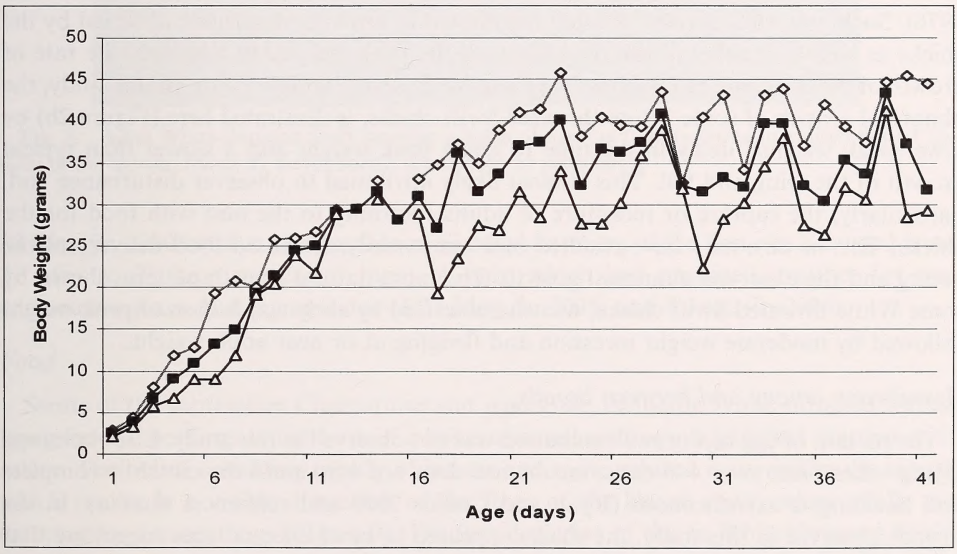


Fig. 2. Growth of (a) wing, tail and (b) body weight of White-throated Swifts in southern California. a. wing length shown by black diamonds; tail length by black squares b. Daily mean body weight shown by black squares. Clear symbols indicate daily maximum (diamonds) and minimum (triangles) weights.

three primaries had some sheathing at their bases as late as day 39 but this was gone by day 42. Tail feathers emerged through the skin at day 9–10 and began erupting through the sheaths at day 17–18.

The growth of the wing and tail was rapid and nearly linear for most of the growth period (Figure 2a). By day 42 the wing lengths of two chicks closely approximated that of adults captured in this study (131–143 mm, mean = 138 mm); three other chicks at ages of 40–41 days had only reached wing lengths of 105–117 mm or 76–85% of adult wing length. Tail feathers reached full adult length of 54–58 mm by day 35–37 (Figure 2a).

The pattern of plumage development in White-throated Swifts closely approximated that documented for the Common Swift (Lack and Lack 1951, 1954). The absence of natal downs in swifts has also been previously documented (Collins 1978).

White-throated Swift chicks increased in body weight from about 2 grams at hatching to as much as 46 grams prior to fledging. From day 2 to day 17 chick growth was nearly linear and increasing at a rate of 2.0 grams per day (Figure 2b). Thereafter, the pattern of growth is highly variable with some individuals reaching a peak weight in excess of 40 g. by day 24 which is >123% of adult mean weight (Table 1) followed by a decline to 30–35 g prior to fledging at day 42–43. This pattern of weight recession has been noted previously in both swifts and swallows (Ricklefs 1968). Weight recession has been attributed to maturation of the integument and feathers accompanied by decrease in water content (Ricklefs 1967, 1968). In this study however, some individuals did not reach peak weight until much later (> day 32) and three chicks reached their peak weight of 43.9–45.5 g at days 40–41 immediately prior to fledging.

What has been termed "abnormal growth" has been documented in a number of avian species (Ricklefs 1976) including swifts (Lack and Lack 1951). It has been largely attributed to a reduction in food delivered to the young, particularly early in the breeding season when normal food supplies are low or not available (Lack and Lack 1951; Ricklefs 1976). Such abnormal growth is often manifested in lower peak weights achieved by the chicks as well as a delay in the time to reach the peak weight. In addition, the rate of growth of the wing and tail feathers may also be slowed (Ricklefs 1976). In this study, the abnormal growth of some White-throated Swift chicks, is illustrated here (Figure 2b) by lower peak weights, delay in the time to reach peak weight and a slower than typical growth of the wing and tail. This is most likely attributed to observer disturbance and, particularly, the capture or recapture of adults returning to the nest with food for the chicks. This in turn may have resulted in a temporarily decreased food delivery to the young and the observed abnormal growth. The more natural growth pattern, shown by some White-throated Swift chicks, was characterized by early acquisition of peak weight followed by moderate weight recession and fledging at or near adult weight.

Asynchrony among and between broods

The pattern of egg laying and incubation was not observed in this study. Elsewhere, egg laying takes place over 4–6 days, incubation does not start until the clutch is complete and hatching is asynchronous (Ryan and Collins 2000 and references therein). In the broods observed in this study, the chicks appeared to be of unequal ages suggesting that hatching took place over 2–3 days in broods of 4. The size differences were more apparent when the chicks were older (>14 days old) and may have been accentuated by nestling competition for food. However, no chicks were observed to suffer severe growth impairment or starvation attributable to such intra-brood competition.

Annual synchrony among broods was generally high with the median age of the chicks in the two nests under observation each year usually differing by only one to five days. However, in 1999, the inter-brood difference in age was 9 days and in 2004 it was an exceptional 13 days. The overall annual difference in age of the broods was 4.8 days (range 1–13 days, SD = 4.2).

By backdating from the age of the oldest chick in the study broods and, assuming a mean incubation period of 24 days (H. Richardson, unpublished, in Ryan and Collins 2000), it was possible to calculate the date of hatching of the first chick and the date of laying of the first egg. The date of laying of the first egg ranged from 27 April (in 2005) to

Fig. 3. Adult White-throated Swift carrying a bolus of nestling food resulting in a distension of the floor of the mouth. Photo by Kevin Smith; reproduced by permission.

30 May (in 2000) with a median date of 13 May; hatching of the first chick ranged from 21 May to 23 June (median 6 June). A pair, which had remained together for two consecutive years, had laying dates of 22 May (in 2005) and 8 June (in 2006).

Food

Swifts of the subfamilies Chaeturinae and Apodinae, including White-throated Swifts, bring food to nestlings in the form of a bolus of aerial arthropods gummed together with saliva. The bolus, consisting mostly of insects and some spiders, is carried in the mouth which results in a visible distension of the floor of the buccal cavity when adults are carrying food to nestlings (Figure 3). The first depiction of this in White-throated Swifts is a sketch by Louis Agassiz Fuertes made in the Chisos Mountains, Texas, in 1901. This sketch (Image # 215804, American Museum of Natural History Library) has been reproduced by Castro and Burke (2007). All prey items are caught on the wing at unknown distances from the nesting location. Each bolus can contain a wide array of prey taxa which range in number from 4–5 larger items to over 200 smaller ones (Rudalevige et al. 2003). During the study period nine such boluses were collected from adults returning to the nests to feed nestlings. Five boluses (1–5) collected between 1997 and 2000 were analyzed previously (Rudalevige et al. 2003); analysis of an additional four boluses (6–9) collected between 2001 and 2004 is included here. One bolus measured 12 × 15 mm and weighed 0.6 g.

In the initial analysis (boluses 1–5) 547 prey items were identified including spiders and seven orders of insects distributed among 50 families or superfamilies (Rudalevige et al. 2003). Hemiptera made up 41.9% of the prey items while Diptera (26.4%) were the most

Table 2. Annual variation in prey types captured by White-throated Swifts from the same nesting location in southern California.

	1997–2000[a] (Boluses 1–5)	2001–2004 (Boluses 6–9)
Hymenoptera	36 (6.58%)	58 (15.34%)
Hemiptera	229 (41.86%)	104 (27.51%)
Diptera	120 (21.94%)	206 (54.49%)
Coleoptera	7 (1.28%)	6 (1.58%)
Psocoptera	147 (27.24%)	-0-
Lepidoptera	1 (0.18%)	-0-
Thysanura	1 (0.18%)	1 (0.76%)
Araneae	4 (0.73%)	3 (0.79%)
Total prey items	547	378
Prey Items/bolus	4–231	44–126
Mean prey items/bolus	109.4	94.50
SD	103.19	35.37

[a] from Rudalevige et al. 2003

diverse with 22 families represented. The four additional boluses (boluses 6–9) contained 378 individuals distributed among five orders of insects and three spiders; family level identifications were not attempted. A comparison of these two data sets (Table 2) shows substantial variation in prey types captured by swifts from the same nesting location in different years. Coleoptera, Thysanura, and Araneae were captured in about the same frequency in boluses 6–9 as in boluses 1–5 (Table 2). Hymenoptera and Diptera were more than twice as frequent in boluses 6–9 while Hemiptera made up a substantially greater percent of the prey items in boluses 1–5 (41.9%) than in boluses 6–9 (27.5%). Psocoptera which made up 27.2% of the prey items in boluses 1–5 were entirely absent from boluses 6–9.

Similar year-to-year variation in the taxonomic composition of swift prey items has been noted in comparisons of boluses obtained from Common Swifts in England (Lack and Owen 1955). Prey diversity also varied in a comparison of prey taken in geographically separated populations of the Alpine Swifts in Europe and South Africa (Collins et al. 2009). There was also substantial bolus to bolus variation in prey type captured during a single breeding season by the Plain Swift (*Apus unicolor*) in the Canary Islands (Garcia-del-Rey et al. 2010).

The size of prey items taken by White-throated Swifts was much less variable than prey taxa between boluses 1–5 and boluses 6–9 (Figure 4). The mean prey size was 3.9 mm and 3.7 mm respectively (Table 3). These means are not significantly different ($T = 1.94$, $p > .05$). The largest prey item identified in boluses 1–5 was 16.7 mm but only 9.9 mm in boluses 6–9. The modal size of prey items was 3 mm in both sampling periods (Figure 4). The larger prey items (> 12 mm) in boluses 1–5 were honeybees (*Apis mellifera*) which made up three of the four prey items in one bolus. Both drone and worker honeybees have been recorded in the diets of other swifts (Lacey 1910; Hess 1927; Bartels 1931; Morse and Laigo 1969; Collins et al. 2009).

The taxonomic diversity of prey items taken by White-throated Swifts in different years at the same location, as well as the bolus-to-bolus variation suggests that these swifts are opportunistic foragers which readily exploit localized or seasonal abundances of prey within a preferred size range. This is in agreement with data from other swift species (Lack and Owen 1955; Thirumurthi and Krisna Doss 1981; Bull and Beckwith 1993;

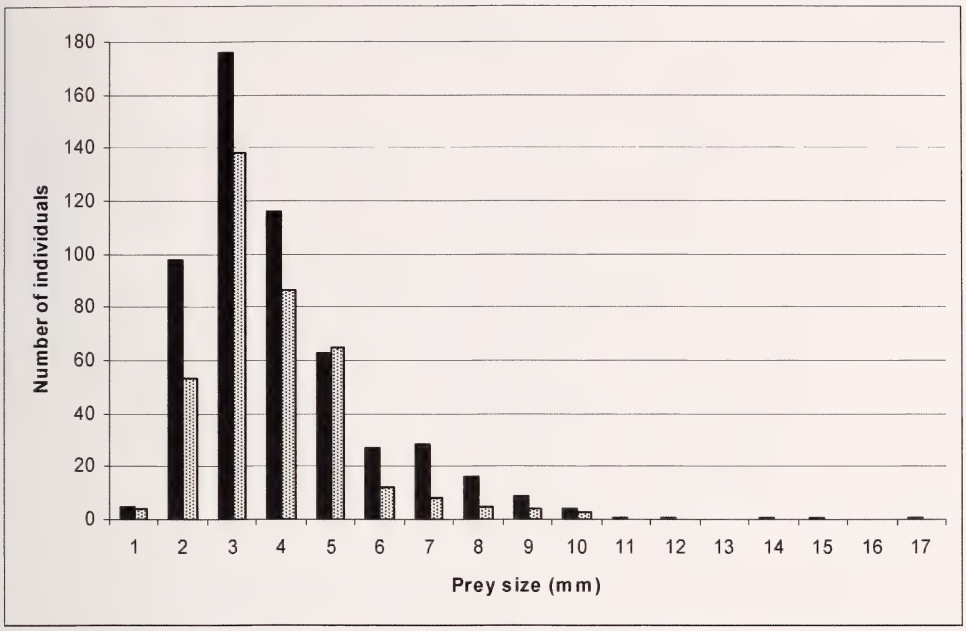


Fig. 4. Sizes of food items delivered to chicks by White-throated Swifts at the same location in southern California in 1997–2000 (black bars) and 2001–2004 (shaded bars).

Tarburton 1986, 1993). The mean prey size taken by White-throated Swifts in both sampling periods is similar to the mean prey size taken by six similar sized swifts in the genera *Apus* and *Tachymarptis* where there is a significant positive correlation between prey size and adult body weight (Collins et al. 2009).

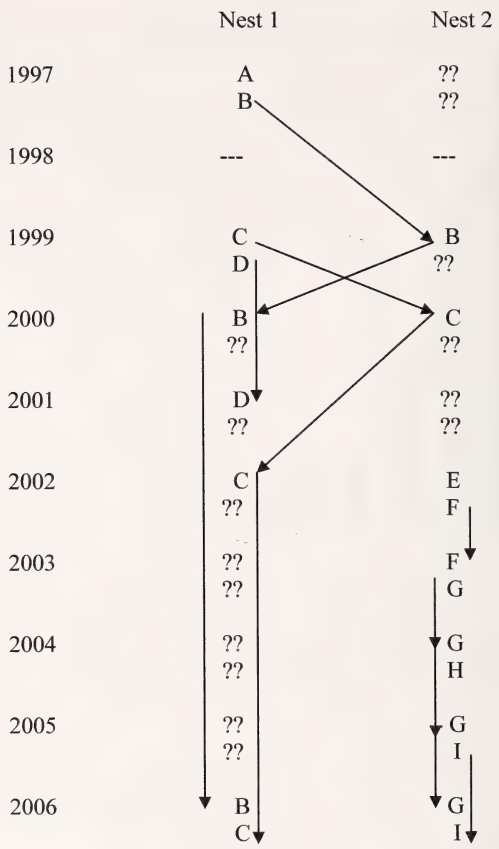
Survival rate, mate and nest site fidelity

White-throated Swifts occupied most or all of the available sites at the study location in all years of this study. Continued site utilization was also noted at other locations in southern California (Bailey 1907; Skinner 1933; Collins 1973). Elsewhere they have been observed at the same nest sites over much longer time intervals (Dobkin et al. 1986). Such traditional nest-site use suggests a high survival rate of adult breeders. No predation on adult White-throated Swifts was documented in this study. One brood of four chicks 9–11 days old, two chicks 30–31 days old in a brood of four, and one chick 35 days old in a brood of three disappeared but no predator was identified.

The small number of adults banded in this study precludes a detailed survival analysis. In addition, not all breeding adults were captured, or recaptured, each year due to the probable disruption of chick provisioning and possible desertion. The available data indicates that 73.9% of the adults were known to be alive from one year to the next. This

Table 3. Annual variation in prey body sizes (mm) taken by White-throated Swifts from the same nesting location in different years in southern California.

Sample	Years of collection	Number of prey items	Mean prey size (mm)	SE	Range
Boluses 1–5	1997–2000	547	3.9	0.09	0.7–16.7
Boluses 6–9	2001–2004	378	3.7	0.08	1.4–9.9



Corresponding U.S.G.S. Band numbers:

A = 752-08627	F = 752-08661
B = 752-08628	G = 752-08671
C = 752-08629	H = 752-08684
D = 752-08636	I = 752-08691
E = 752-08660	

Fig. 5. Nest site and mate site fidelity of banded White-throated Swifts in southern California. No data were collected in 1998. Sexes were not determined. No attempt was made to capture all adults each year to avoid disturbance and possible desertion.

is a minimal value as it does not include the probability that others were alive but not recaptured or had emigrated to other nest sites at this or a more distant location One adult banded in July 1997 was still present and breeding in June 2006. The age of first breeding in White-throated Swifts is not known. If it is assumed to be when they are one year old then this individual would have been 10 years old when last recaptured. Similarly, another individual was eight years old when last recaptured in 2006.

Nest site fidelity was variable in this study (Figure 5). One individual moved from nest hole one in 1997 to nest hole two in 1999 and was found back at nest hole one in 2000. Another individual was at nest hole one in 1999, nest hole two in 2000 and back at nest hole one in 2002. These two individuals were together at nest hole one in 2006 and were probably there together from 2002 to 2006 but were not recaptured during this interval.

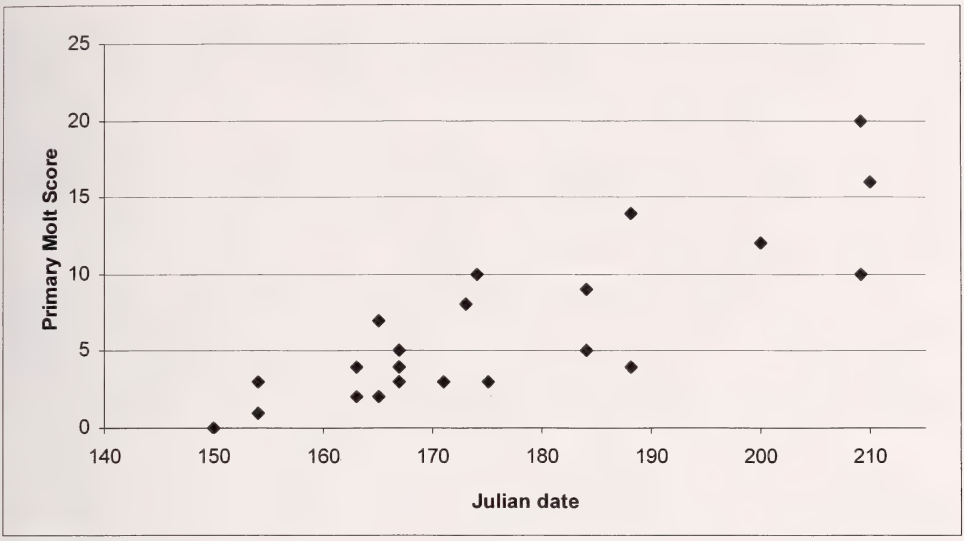


Fig. 6. Comparison of molt score of primary feathers and Julian date in White-throated Swifts in coastal southern California. Julian dates: June 1 = day 153, June 15 = day 167, July 1 = day 183, July 15 = day 197. For explanation of molt scores see methods.

This would be the longest duration of a pair bond in this species. One additional pair was together at nest hole two in both 2005 and 2006 (Figure 5).

Annual survival rates of adult swifts are generally higher than the rates for other similar sized terrestrial bird species and approach the values for some traditionally long-lived seabirds. Survival estimates for three European swifts ranged from 74% to 84% (Lack and Arn 1953; Arn-Willi 1960; Perrins 1971; Boano et al. 1993; Thomson et al. 1996) and 85% for one Neotropical species (Collins 1974).

Data on mate and nest site fidelity in swifts is limited. In a study of the Pallid Swift in Italy (Boano et al. 1993), some individuals repeatedly changed nest cavities and mates from year to year; one male nested in five different cavities with four different females in successive years. On average Pallid Swifts changed mates 58.3% of the time in successive years. The greatest mate fidelity recorded was a pair of these swifts found together for three breeding seasons (Boano et al. 1993). In the Common Swift, pairs often remain together for many years (Weitnauer 1990). In a study of 47 pairs, mate fidelity averaged 3.9 years with one pair staying together for 13 years (Weitnauer 1990). However, some breeders dispersed and were recaptured at other colonies 6–36 km away (Weitnauer 1990).

Adult Molt

Adult White-throated Swifts molt their flight feathers once a year, a process that may take up to 6–7 months (Marin 2003). The molt of the tail and body contour feathers begins after the molt of the primaries are well advanced (after primaries 4–6 have been replaced) and are completed at the same time or shortly before completion of the molt of the primaries (Marin 2003). In this study, the annual molt began in early June with the replacement of the innermost primaries; two individuals caught in late May had not begun to molt (Figure 6). The molt progressed slowly but steadily (from innermost outward) through late July when typically, the first two or three primaries had been replaced and the next was being regrown (Figure 6). Usually only one or two primaries

were in molt at the same time with the next outermost feather being dropped when the preceding one was about 2/3–3/4 regrown. No molt of the tail or body contour feathers had begun during the term of this study.

The timing of primary feather molt was very similar from year to year (Figure 6). Individuals captured multiple times over the course of this study likewise showed substantial agreement in the stage of primary molt on similar dates in different years. Little year-to-year variation in the timing of molt was also noted in a desert breeding population of White-throated Swifts (Marin 2003).

In this study, the onset of the annual molt overlapped broadly with the breeding cycle. The molt of the primaries began in early June, which was at the end of egg-laying period and in the middle of the hatching period of the chicks. The molt progressed throughout the chick-rearing period, which ended in late July; the molt presumably continued, as in other populations (Marin 2003), for several months thereafter.

In a desert inhabiting population of White-throated Swifts at least some individuals began laying eggs in early April (Marin 2003) and some initiated molt in late April or early May although the majority did not start their molt until late May or early June (Marin 2003) as also shown here for a coastal population. This resulted in a decreased degree of overlap of molt and breeding in the desert population. Other studies have documented a broad overlap in the molt and breeding seasons in many species of swifts (Collins 1968; Marin and Stiles 1992; Bull and Collins 1993; Tarburton 2003, 2009; Collins unpublished data). Molt-breeding overlap is also shown in this study of a coastal population of White-throated Swifts. The strong correlation between molt stage and date with little inter-year variation in the timing of molt initiation, but not the start of breeding, (Marin 2003; this study) suggests that the onset of breeding and the annual molt in White-throated Swifts, and possibly other species of swifts (Collins 1968), are triggered by differing environmental stimuli.

Although much information has been gathered to date about the biology of White-throated Swifts, some of it is almost anecdotal. Thus, there is still much more to be learned about this species. Such additional information will facilitate more detailed comparisons with data currently available for other species of swifts.

Acknowledgments

I am indebted to Peter Bloom for finding this site and alerting me to the study possibilities. Patricia Collins, Tom Ryan, Matt Amalong, Spencer Langdon, Nate Mudry and John Fitch each accompanied me on one or more visits to the site. I am grateful for their assistance and company and to David Schmitz who prepared Figure 1. I am also grateful to Kevin Smith for permission to include his exceptional photograph of an adult carrying food to nestlings (Figure 3). Banding was done under Master Banding Permit No. 08707 and a protocol approved by the Institutional Animal Care and Use Committee, California State University, Long Beach.

Literature Cited

Arn-Willi, H. 1960. Biologische studien am Alpensegler. Verlag Vogt-Schild AG, Solothurn.

Bailey, F.M. 1907. White-throated Swifts at Capistrano. Condor, 9:169–172.

Bartels, M. Jr. 1931. Sind die Segler immune gegen das Gift Stachelbewehrter hymenopteren? Ornith. Monatsber., 39:176 pp.

Bartholomew, G.A., T.R. Howell, and T. Cade. 1957. Torpidity in the White-throated Swift, Anna Hummingbird and Poorwill. Condor, 59:145–155.

Bent, A.C. 1940. Life histories of North American cuckoos, goatsuckers, hummingbirds and their allies. U. S. Nat. Mus. Bull., 176:1–506.

Boano, G. and M. Cucco. 1989. Breeding biology of the Pallid Swift (*Apus pallidus*) in NW Italy. Gerfaut, 79:133–148.

———, ———, G. Malacarne, and G. Orecchia. 1993. Survival rate and mate fidelity in the Pallid Swift *Apus pallidus*. Avocetta, 17:189–197.

Bradbury, W.C. 1918. Notes on the nesting habits of the White-throated Swift in Colorado. Condor, 20: 103–110.

Bull, E.L. and R.C. Beckwith. 1993. Diet ad foraging behavior of Vaux's Swifts in northeastern Oregon. Condor, 95:1016–1023.

——— and C.T. Collins. 1993. Nesting chronology, molt and ectoparasites of Vaux's Swifts in northeastern Oregon. Avocetta, 17:203–207.

Carriker, M.A. Jr. 1954. Studies in Neotropical Mallophaga, XI: bird lice of the suborder Amblycera, genus *Dennyus* (Neumann). Proc. U. S. Nat. Mus., 103:533–539.

Castro, S.D. and H.R. Burke. 2007. Louis Agassiz Fuertes and the biological survey of Trans-Pecos Texas. Bull. Texas Ornith. Soc., 40:49–61.

Chantler, P. 2000. Swifts. A guide to the swifts and treeswifts of the world. 2nd ed., Yale University Press, New Haven.

Collins, C.T. 1968. The compatative biology of two species of swifts in Trinidad, West Indies. Bull. Fla. State Mus., Biol. Sci., 11:257–320.

———. 1973. Notes on survival and band wear in White-throated Swifts. Western Bird Bander, 48:20–21.

———. 1974. Survival rate of the Chestnut-collared Swift. Western Bird Bander, 49:50–53.

———. 1978. Natal pterylosis of hummingbirds. Bull. So. Calif. Acad. Sci., 77:14–21.

——— and E.V. Johnson. 1982. Further records of White-throated Swifts utilizing man-made structures. Western Birds, 13:25–28.

———, J.L. Tella, and B.D. Colahan. 2009. Food habits of the Alpine Swift on two continents: intra- and interspecific comparisons. Ardeola, 56:259–269.

Davis, F.W., D.M. Stems, A.D. Hollander, K.A. Thomas, P.A. Stine, D. Odion, M.I. Borchet, J.H. Thorne, M.V. Gray, R.E. Walker, K. Warner, and J. Graae. 1998. Gap analysis of mainland California: an interactive atlas of terrestrial biodiversity and land management (Compact Disk). Biodiversity Lab, Univ. of California, Santa Barbara, Available at: http://www.biogeog.ucsb.edu/projects/gap/gap_cdrom.html.

Dobkin, D.S., J.A. Holmes, and B.A. Wilcox. 1986. Traditional nest-site use by White-throated Swifts. Condor, 88:252–253.

Dunning, J.B. Jr., ed. 1993. CRC handbook of avian body masses. CRC Press, Inc., Boca Raton, Florida.

Garcia-del-Rey, E., C.T. Collins, and N.W. Volpone. 2010. Food habits of the endemic Plain Swift *Apus unicolor* in the Canary Islands. ARDEA, In press.

Gladwin, T.W. and B.S. Nau. 1964. A study of Swift weights. Brit. Bds, 57:344–356.

Gory, G. 1987. Influence du climat mediterraneen sur la reproduction du Martinet Noir (*Apus apus* L.). L'Oiseau et R. F. O., 57:69–84.

Hanna, W.C. 1917. Further notes on the White-throated Swifts of Slover Mountain. Condor, 19:3–8.

Hess, A. 1927. Aus dem speisezettel des Alpenseglers, *Apus m.melba* L. Ornith. Beobachter, 24:247.

Kaiser, E. 1992. Populationdynamik einer Mauersegler *Apus apus* kolonie unter besonderer Berücksicht der nichbrüter. Vogelwelt, 113:71–81.

Lacey, E. 1910. Swifts eating drones of the hive bee. Brit. Birds, 3:263.

Lack, D. 1956. Swifts in a Tower. Methuen and Co. Ltd., London.

——— and H. Arn. 1953. Die nittlere Lebensdauer des Alpenseglers. Ornith. Beobachter, 50:133–136.

——— and E. Lack. 1951. The breeding biology of the Swift *Apus apus*. Ibis, 93:501–546.

——— and ———. 1954. The home life of the Swift. Sci. Amer., 191:60–64.

——— and D.F. Owen. 1955. The food of the Swift. Jour.Animal Ecol., 24:120–126.

Marin, M. 2003. Molt, plumage, body mass, and morphometrics of a population of the White-throated Swift in Southern California. Western Birds, 34:216–224.

——— and F.G. Stiles. 1992. On the biology of five species of swifts (Apodidae, Cypseloidinae) in Costa Rica. Proc.West. Found. Vert. Zool., 4:287–351.

Morse, R.A. and F.M. Laigo. 1969. The Philippine Spine-tail Swift, *Chaetura dubia* McGreggor, as a honey bee predator. Philippine Entomologist, 1:138–143.

Naik, S. and R.M. Naik. 1966. Studies on the House Swift, *Apus affinis* (G. E. Gray) 6. Body weight. Pavo, 4:84–91.

Newton, I. 1966. The moult of the Bullfinch *Pyrrhula pyrrhula*. Ibis, 108:41–67.

Perrins, C.M. 1971. The age of first breeding and adult survival rates in the Swift. Bird Study, 18:61–70.

Peterson, P.C., W.T. Atyeo, and W.W. Moss. 1980. The feather mite family Eustathiidae (Acarina: Sarcoptiformes). Acad. Nat. Sci. Philadelphia Monogr., 21:1–143.

Rudalevige, A.D., D.L.A. Underwood, and C.T. Collins. 2003. Diet of breeding White-throated and Black Swifts in Southern California. Western Birds, 34:209–215.

Ricklefs, R.E. 1967. Relative growth, body constituents, and energy content of nestling Barn Swallows and Red-winged Blackbirds. Auk, 84:560–570.

———. 1968. Weight recession in nestling birds. Auk, 85:30–35.

———. 1976. Growth rates of birds in the humid New World tropics. Ibis, 118:179–207.

Ryan, T.P. and C.T. Collins. 2000. White-throated Swift (*Aeronautes saxatalis*). In The Birds of North America, No. 526. (A. Poole and F. Gill, eds.) The Birds of North America, Inc., Philadelphia, PA.

——— and ———. 2003a. Social behavior of White-throated Swifts. Western Birds, 34:204–208.

——— and ———. 2003b. Activity patterns of White-throated Swifts in California. Western Birds, 34: 186–198.

——— and ———. 2003c. Seasonal population fluctuation of White-throated Swifts at roost sites in southern California. Western Birds, 34:199–203.

Skinner, M.P. 1933. White-throated Swifts at San Juan Capistrano. Condor, 35:241.

Tarburton, M.K. 1986. Food of the White-rumped Swiftlet (*Aerodramus spodiopygius*) in Fiji. Notornis, 33:1–16.

———. 1993. The diet of the White-rumped Swiftlet (*Aerodramus spodiopygius*) in Queensland's savannah. Avocetta, 17:125–129.

———. 2003. Breeding biology of the Mountain Swiftlet *Aerodramus hirundinaceus* in Irian Jaya. Emu, 103:177–182.

———. 2009. The breeding biology of the White-rumped Swiftlet *Aerodramus spodiopygius spodiopygius* in Samoa. Corella, 33:1–6.

Thirumurthi, S. and D. Krishna Doss. 1981. A note on the feeding habits of swifts (Apodidae: Apodiformes). J. Bombay Nat. Hist. Soc., 78:378–379.

Thomson, D.L., H. Douglas-Home, R.W. Furness, and P. Monaghan. 1996. Breeding Success and survival in the Common Swift *Apus apus*: a long-term study on the Effects of weather. J. Zool. Lond., 239:29–38.

Usinger, R.L. 1996. Monograph of Cimicidae (Hemiptera-Heteroptera). The Thomas Say Foundation, 7: 1–585.

Weitnauer, E. 1990. Mein Vogel. 4th Ed. Baselland Schaftlich er Natur- und Vogelschutzverband, Liestal.

Accepted for publication 9 December 2009.

Bull. Southern California Acad. Sci.
109(2), 2010, pp. 37–44
© Southern California Academy of Sciences, 2010

Occurrence of the Barnacle (*Xenobalanus globicipitis*) on Coastal and Offshore Common Bottlenose Dolphins (*Tursiops truncatus*) in Santa Monica Bay and Adjacent Areas, California

Maddalena Bearzi[1] and Katalin Patonai[2]

[1,2]*Ocean Conservation Society, P.O. Box 12860, Marina del Rey, California 90295*

Abstract.—Occurrence and distribution of pseudostalked barnacle (*Xenobalanus globicipitis*) on bottlenose dolphin (*Tursiops truncatus*) were assessed during a 1997–2007 study in Santa Monica Bay and nearby areas, California. During 425 surveys, 647 individuals were observed to assess presence and prevalence of barnacles; 92 barnacles on 56 individual (8.66%) were observed. On average, one barnacle was found on individuals, usually on top of dorsal fins (97.83%). No significant difference between barnacles' numbers on coastal versus offshore sightings was recorded. A significant difference on their occurrence on dolphins was recorded between seasons and years. Barnacles affect a small portion of the dolphin population in the study area.

Introduction

The pseudostalked barnacle (*Xenobalanus globicipitis*) is a cosmopolitan species that has been associated with 34 different cetacean species (Spivey 1981; Rajaguru and Shantha 1992; Kane *et al.* 2008 for a review). The presence of this barnacle on common bottlenose dolphin (hereafter bottlenose dolphin), *Tursiops truncatus*, have been studied in the eastern tropical Pacific Ocean (Kane *et al.* 2008), in the western Pacific Ocean (Orams and Schuetze, 1998), in the northwest Atlantic Ocean (Toth-Brown and Hohn 2007), in the southwest Atlantic Ocean (Di Beneditto and Ramos 2000) and in the Indian Ocean (Rajaguru and Shantha 1992; Karuppiah *et al.*, 2004).

Pseudostalked barnacles attach themselves to dorsal fins (generally trailing edges), pectoral flippers and tail flukes of dolphins (Dhermain *et al.* 2002; Seilacher 2005; Toth-Brown and Hohn 2007) and, in rare cases, they can be found on rostra and in between their teeth (Samaras, 1989). These barnacles are obligate commensals - that "use" dolphins for transportation (Toth-Brown and Hohn 2007) - sometimes creating drag or causing irritation to their host (Dhermain *et al.* 2002; Fertl and Newman 2008). Their presence varies greatly with host species, ranging from one to over 100 barnacles per host (Aznar *et al.* 2005; Toth-Brown and Hohn 2007).

Unhealthy cetaceans are usually more susceptible to attachment by barnacles due to impairment of their immune system and/or presence of skin diseases (Aznar *et al.* 1994; Aznar *et al.* 2005). Barnacles are also commonly found on stranded cetaceans (Dailey and Walker 1978; Dhermain *et al.* 2002; Karuppiah *et al.* 2004; Aznar *et al.* 2005). Considering that unhealthy cetaceans carry more barnacles than healthy ones, the high presence of these barnacles in wild cetacean populations is likely to be an indication of the overall health of the host population (Aznar *et al.* 2005). Factors such as age and swimming speed of host individuals, and oceanographic conditions (e.g., water temperature, primary productivity), however, have also been suggested to affect the settlement of barnacles on dolphins (Van Waerebeek *et al.* 1993; Aznar *et al.* 1994; Orams and Schuetze 1998; Toth-Brown and Hohn 2007; Kane *et al.* 2008).

Data on presence, prevalence and distribution of this barnacle on cetaceans like bottlenose dolphins are keys in understanding the cause and effect of settlement and the ecological relationships between these species. Only two studies, however, have been published on this subject (Toth-Brown and Hohn 2007; Kane *et al.* 2008). This study, conducted between 1997–2007 as a part of a larger systematic photo-identification and ecological investigation on bottlenose dolphins (Bearzi 2005; Bearzi *et al.* 2009), reports the occurrence of *Xenobalanus* on wild bottlenose dolphins frequenting the coastal and offshore waters of Santa Monica Bay and adjacent waters in California. This investigation provides the first report on presence, prevalence and distribution patterns of *Xenobalanus* on dolphins in the study area over a ten year-period. This investigation also offers data for comparison with other study areas in which these barnacles have been recorded on dolphin.

Methods

Study area

Santa Monica Bay (approximately 460 km^2) is bounded by the Palos Verdes Peninsula to the south (33°45′N, 118°24′W), Point Dume to the north (33°59′N, 118°48′W), and the edge of the escarpment to the west. The bay is characterized by three submarine canyons: Dume and Redondo Canyons head in shallow water (50 m), whereas Santa Monica Canyon begins at a depth of about 100 m. The mean depth is about 55 m and the maximum depth 450 m. Surveys were also conducted outside the bay, both along the coast (at 0.5 km from shore) to the south (33°43′N, 118°15′W) and to the north (34°5′N, 119°6′W), and in pelagic waters off Catalina (33°23′N, 118°41′W) and Santa Barbara Islands (33°27′N, 119°3′W), up to 65 km offshore in the Southern California Bight (Fig. 1). The bay has mild temperatures, short rainy winters and long, dry summers. Normal water surface temperatures range from 11 to 22°C.

Data collection and analyses

Data on barnacle occurrence on bottlenose dolphins for this study were collected from marine mammal surveys conducted between February 1997-June 2002 and June 2005-July 2007 (Bearzi *et al.* 2009). Only data collected on photo-identified bottlenose dolphins were analyzed to assess barnacle presence on each individual.

Field surveys.—Coastal (distance from shore up to 1 km) and offshore (distance from shore >1 km) surveys were conducted with an average of 5.2 days on the water per month (n = 425) in Santa Monica Bay and adjacent areas (Bearzi *et al.* 2009). No data were collected: Dec. 1999, Oct. 2000, July 2001, Sep. 2001, July 2005, Dec. 2005, May 2006, Feb.-Apr. 2007. Routes, planned for an even coverage of the study area, were surveyed from 7-m (1997–2000) and 10-m power boats (2001–2002, 2006–2007), and a 17-m sailboat (2005), at an average speed of 18 km hr^{-1}. Data on dolphin behaviour were collected with laptop computers and recorded at 5-min intervals throughout each sighting (Bearzi 2005).

Photo-identification.—For each sighting of dolphin schools, we attempted to photograph all individuals. An effort to take high quality close-up images of bodies and dorsal fins of dolphins in each school was made to ensure a significant dataset to analyze skin lesions and physical deformities (Bearzi *et al.* 2009) and barnacle presence (this study) on dolphins. Color photographs were taken with 35-mm Canon EOS1N and A2 cameras equipped with 75–300mm lenses, and a digital Canon 5D equipped with 400mm lens. A total of 810 images were scanned and matched using a computer-assisted

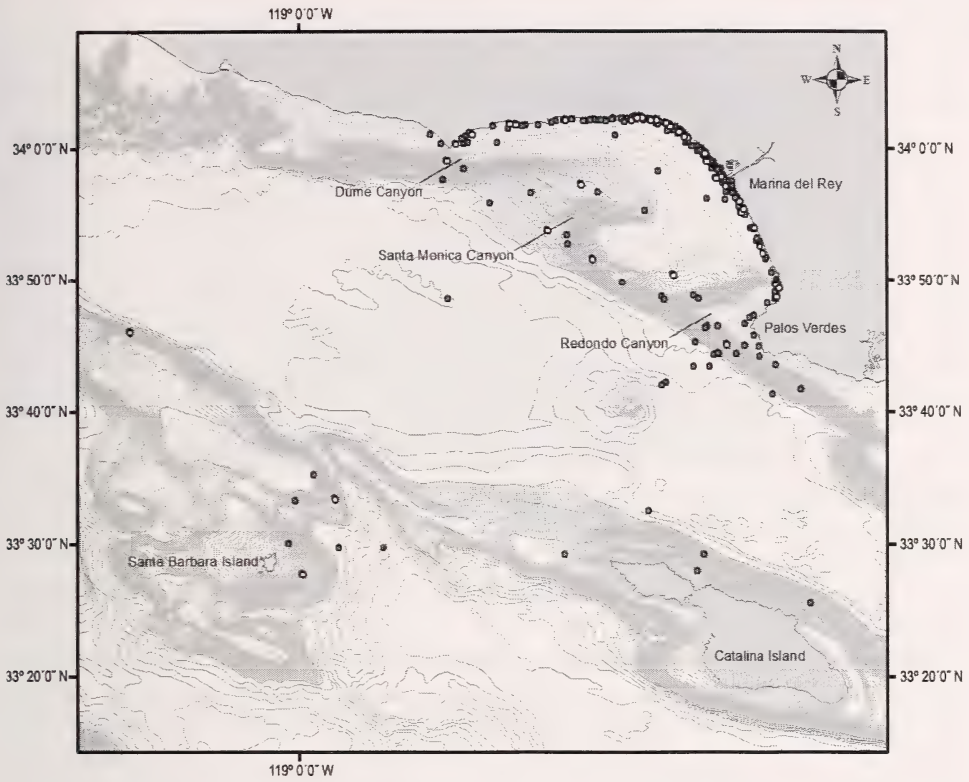


Fig. 1. The study area and the distribution of coastal and offshore bottlenose dolphins in Santa Monica Bay and adjacent waters. Each symbol (white circle: sightings with barnacles; grey circle: sightings without barnacles) represents initial GPS coordinates of photo-identified bottlenose dolphin sightings.

identification system (1997–2002; *Finscan;* Kreho *et al.* 1999). A total of 464 digital images were catalogued and matched utilizing ACDSee software (2005–2007; Mazzoil *et al.* 2004, modified).

Distinct coastal and offshore individuals for the study area were identified based on matching procedures focusing on 195 sightings (88.2% of total dolphin sightings, n = 221). A total of 647 distinct individuals (50.8% of total identified and resighted individuals, n = 1274) were recognized in the study area between 1997–2007 (Bearzi *et al.* 2009).

Images of dolphin dorsal fins, flukes and bodies taken during photo-identification studies offer a great tool to assess presence of barnacles (Speakman *et al.* 2006). All 647 distinct individuals were analyzed to assess *presence* and *prevalence* of barnacles (only the dorsal fins was considered for analysis in this study), using Acdsee Pro and Photoshop 8.0. Each image was enlarged to record barnacle number and position on fins. Scanned images of the same individuals catalogued in 1997–2002 were also analyzed to assess barnacle presence and prevalence. Calves were excluded from this analysis.

Barnacle presence analysis.—Barnacle *presence* was recorded as the total number of barnacles on the dorsal fin of an individual dolphin. For analysis, a subset of data of photo-identified and resighted individuals (n = 1225; 96.2% of entire data set, n = 1274) was used due to: 1) incomplete image data, and 2) avoid data replication of barnacle presence (only one image was considered of the same photo-identified dolphin per survey

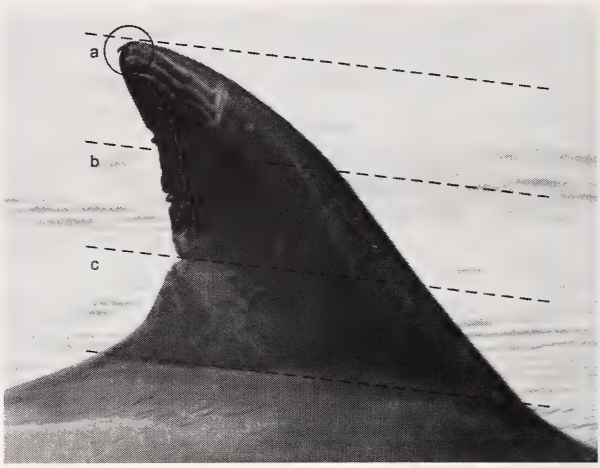


Fig. 2. Division of the dorsal fin into three segments of equal height: a) top, b) center, and c) bottom. A *Xenobalanus* specimen is visible on the top segment of the fin.

day). A total of 189 sightings were included in the analysis (85.5% of total dolphin sightings, $n = 221$).

Barnacle prevalence and position on dorsal fin.—Prevalence of *Xenobalanus* for each sighting was determined by dividing the number of photo-identified dolphins carrying one or more barnacles by the total number of dolphins photo-identified in that sighting (Kane *et al.*, 2008). To determine the *position* of barnacles on dorsal fins, the fin was divided into three segments of equal height (Fig. 2). The lower margin of the dorsal fin was defined as the straight line where the plane of the dorsal fin changes to that of the body.

Data analyses.—Data analyses were performed using Statview 5.0, Microsoft Excel 2007; data on species distribution were plotted with ArcGIS 9.2. Nonparametric statistics tests were performed due to non-normal distributions of data. Statistical significance was set at $P < 0.05$ and two-tailed P values were calculated. Kruskal-Wallis test was used both to determine whether barnacle presence varied significantly over the years and between the seasons. Dunn's comparison test was used as a post-hoc analysis to determine differences between years. To determine whether there was a significant difference between barnacle presence on coastal and offshore bottlenose dolphins, nonparametric Mann-Whitney U test was used. Chi-square (χ^2) test of independence was used to determine if there was a relationship between barnacle presence and survey type (coastal/offshore).

Results

Field effort

Barnacle occurrence was analyzed on a dataset of 204 coastal and 221 offshore surveys conducted in the years 1997–2002 and 2005–2007 (Bearzi *et al.* 2009). A total of 823 h were spent searching for cetaceans in good weather conditions and 400 h observing 509 dolphin schools. Of these schools, 221 were bottlenose dolphins.

Presence, prevalence and position of barnacles on dolphins

A total of 92 barnacles on 56 distinct individual dolphins (8.66% of total number of distinct individuals, $n = 647$) were observed in the study area between 1997–2007

Table 1. Summary of barnacle presence on coastal and offshore bottlenose dolphins in Santa Monica Bay and adjacent areas between 1997–2007.

Survey type	Photo-identified dolphins	Number of photo-identified dolphins with barnacles	Total number of barnacles on photo-identified individuals	Distinct individual dolphins with barnacles
Coastal	924	64	77	44
Offshore	301	13	15	12
Total	1225	77	92	56

(Table 1). Photo-identified individuals carrying *Xenobalanus* were usually found with one barnacle (mean = 1.19, $SD = 0.51$, $SE = 0.06$, range = 1–4, $n = 77$; Fig. 3). There was no significant difference between the average number of barnacles found on coastal and offshore individuals (Mann-Whitney: $P = 0.972$; coastal: mean = 1.20, $SD = 0.54$, $SE = 0.07$, range = 1–4, $n = 65$; offshore: mean = 1.17, $SD = 0.39$, $SE = 0.11$, range = 1–2, $n = 12$).

Barnacles were observed in 54 different sightings (28.57% of total number of sightings, $n = 189$). Mean prevalence of *Xenobalanus* per sighting was 0.05 ($SE = 0.008$, n sightings = 189), and did not differ significantly between coastal and offshore sightings (Mann-Whitney: $P = 0.889$; coastal: mean = 0.05, $SD = 0.12$, $SE = 0.01$, range = 0–1, $n = 161$; offshore: mean = 0.04, $SD = 0.07$, $SE = 0.01$, range = 0–0.33, $n = 28$).

In total, 90 barnacles (97.83% of total number of barnacles, $n = 92$) were located on the top segment of the dorsal fin, two (2.17%) on the middle section and no barnacles were observed at the bottom. All of the barnacles were found along the trailing edge of the dorsal fin.

Occurrence and distribution of barnacles

Occurrence of barnacles on photo-identified bottlenose dolphins is shown in Table 2 and it differed significantly between years (KW = 33.40, DF = 8, $P < 0.0001$), with 1999 showing individuals with the greatest number of barnacles (Bonferroni-Dunn: $P < 0.0001$).

Overall, most barnacles were recorded in spring ($n = 41$). Winter had the fewest barnacles ($n = 3$) while a total of 31 and 17 barnacles were recorded respectively in summer and fall. Significant difference in barnacle occurrence was also observed between

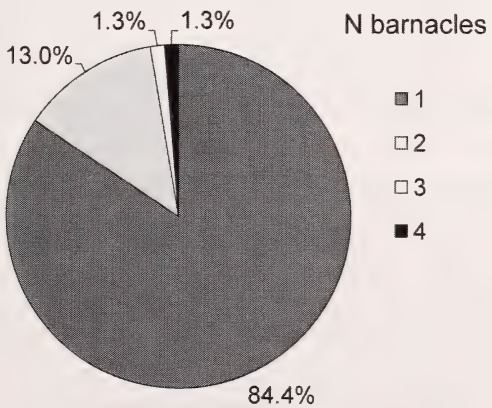


Fig. 3. Percentage of photo-identified dolphins carrying one or more barnacles.

Table 2. Summary of barnacle number and occurrence on photo-identified bottlenose dolphins recorded in Santa Monica Bay and adjacent areas. Data in parentheses represent the total number of distinct individual dolphins and the number of distinct individuals with barnacles, respectively.

Years	Photo-identified dolphins	Photo-identified dolphins with barnacles	Total number of barnacles
1997	61 (47)	1 (1)	1
1998	334 (170)	22 (15)	22
1999	178 (105)	28 (19)	39
2000	109 (77)	5 (3)	5
2001	69 (61)	2 (1)	3
2002	10 (10)	1 (1)	1
2005	90 (89)	5 (5)	6
2006	201 (188)	7 (7)	7
2007	173 (153)	6 (7)	8
Total	1225	77	92

seasons (KW = 8.42, DF = 3, $P = 0.038$) There was no significant difference between survey type (coastal/offshore) and barnacle occurrence ($\chi^2 = 2.197$, DF = 1, $P = 0.138$). The distribution of *Xenobalanus* on coastal and offshore bottlenose dolphins is presented in Figure 1.

Discussion and Conclusions

Presence, prevalence and position of barnacles on dolphins

Presence of *Xenobalanus* on dorsal fins of coastal and offshore bottlenose dolphins in Santa Monica Bay was similar to other regions worldwide (Tangalooma, Australia: Orams and Schuetze 1998; Rio de Janeiro, Brazil: DiBeneditto and Ramos 2000; eastern tropical Pacific Ocean: Kane *et al.* 2008), and low in comparison to the northwest Atlantic Ocean (New Jersey coast: Toth-Brown and Hohn 2007). We recorded a maximum of four barnacles per individual while Toth-Brown and Hohn (2007) reported over 10 barnacles on bottlenose dorsal fins for the Atlantic Ocean.

In Santa Monica Bay, 29% of sightings had individuals carrying barnacles and a review by Kane *et al.* (2008) for the eastern tropical Pacific Ocean shows barnacle presence in less than 10% of sightings. Overall, these data show a lower presence of *Xenobalanus* on bottlenose dolphins in comparison to the Atlantic Ocean (Toth-Brown and Hohn 2007: 64% sightings with barnacles). Prevalence of *Xenobalanus* in the study area was also lower in comparison to the Atlantic Ocean (our study: 5%; New Jersey coast: 55%, Toth-Brown and Hohn 2007) and more similar to Kane *et al.* (2008) for the eastern tropical Pacific Ocean (0.2%). These differences in barnacle presence and prevalence between the Pacific and Atlantic Ocean may be related to habitat as suggested by Kane *et al.* (2008).

In this study, all barnacles were found along the trailing edge of the dorsal fin and, for the most part, attached to the top segment making them generally visible from both sides. In other studies where the presence of barnacles was generally high, however, *Xenobalanus* were recorded on all fin segments (Toth-Brown and Hohn 2007). It is possible that barnacles have a preference for settling on the top of dorsal fins when present in low number (as shown in our study area) but, when they are present in high numbers, they may also spread to other segments of the fin, as observed by Toth-Brown and Hohn (2007). Further, barnacles not settling along trailing edges are likely to be swept off (Rajaguru and Shantha 1992).

Occurrence and distribution of barnacles

No difference in barnacle occurrence and distribution was observed between coastal and offshore bottlenose dolphins in the study area, contrary to reports for the Northwest Atlantic Ocean (Rittmaster *et al.* 1999; Toth-Brown and Hohn 2007). These studies found more dolphins with barnacles in offshore waters than in estuarine or coastal waters (Beaufort, North Carolina: Rittmaster *et al.* 1999; New Jersey coastline: Toth-Brown and Hohn 2007). In these authors' opinion, diverse coastal and offshore habitats and habitat use were the reason for these differences. In Santa Monica Bay, a slight spatial overlap between coastal and offshore individuals (Bearzi *et al.* 2009) may be responsible for the lack of a significant difference in barnacle occurrence on coastal versus offshore dolphins.

Occurrence of barnacles on photo-identified dolphins for the study area varied between years, with the highest presence in 1998–1999 and the lowest in 1997 and 2002. Our study recorded most barnacles on dolphins during La Niña event in 1999. From April 1997 through March 1998, considered a warm El Niño period (Grover *et al.* 2002), no barnacles were recorded. From April 1998, barnacle occurrence increased again, while El Niño weakened, shifting into La Niña in July 1998 (Enfield 2001), showing a potential correlation between low barnacle occurrence and El Niño events. Kane *et al.* (2008) observed *Xenobalanus* in areas of increased primary productivity suggesting that it may indirectly limit barnacle presence in oligotrophic areas. Further studies are necessary to better understand the relationship between barnacle occurrence on dolphins and shifts in oceanographic conditions.

Xenobalanus occurrence also varied between seasons with most barnacles found in spring and fewest in winter. In Australian waters, True (1890) observed similar trends while Orams and Schuetze (1998) reported seeing more barnacles in cold temperatures than in warm. In the northern Atlantic Ocean, Toth-Brown and Hohn (2007) did not find changes in barnacle numbers between May and September. It is possible that spawning occurs at different times of the year (Van Waerebeek *et al.* 1993; Toth-Brown and Hohn 2007), or that barnacle occurrence is not primarily influenced by water temperature.

Acknowledgements

The field research was funded by Ocean Conservation Society. Thanks to all the Los Angeles Dolphin Project research assistants and volunteers. Special acknowledgments to ESRI for the ArcGis software, Maptech for the PC Chart Navigator software, and IFAW for the Logger software. This study was conducted following guidelines of the American Society of Mammalogists. Fieldwork was conducted following the laws of California and the General Authorization for Scientific Research issued by the National Oceanic and Atmospheric Administration (files # 856-1366 and # 8561835, Silver Spring, Maryland).

Literature Cited

Aznar, F.J., J.A. Balbuena, and J.A. Raga. 1994. Are epizoites biological indicators of a western Mediterranean striped dolphin die-off? Dis. Aquat. Org., 18:159–163.

———, D. Perdiguero, A. Pérez del Olmo, A. Repullés, C. Agusti, and J.A. Raga. 2005. Changes in epizoic crustacean infestations during cetacean die-offs: the mass mortality of Mediterranean striped dolphins *Stenella coeruleoalba* revisited. Dis. Aquat. Org., 67:239–247.

Bearzi, M. 2005. Aspects of the ecology and behaviour of bottlenose dolphins (*Tursiops truncatus*) in Santa Monica Bay, California. J. Cetacean Res Manage., 7(1): 75–83.

———, S. Rapoport, J. Chau, and C. Saylan. 2009. Skin lesions and physical deformities of coastal and offshore common bottlenose dolphins (*Tursiops truncatus*) in Santa Monica Bay and adjacent areas, California. Ambio, 38(2): 66–71.

Dailey, M.D. and W.A. Walker. 1978. Parasitism as a factor (?) in single strandings of Southern California cetaceans. J. Parasitol., 64:593–596.

Dhermain, F., L. Soulier, and J.-M. Bompar. 2002. Natural mortality factors affecting cetaceans in the Mediterranean Sea. Pp. 1–14 in Cetaceans of the Mediterranean and Black Seas: State of Knowledge and Conservation Strategies. (G. Notarbartolo di Sciara, ed.), A report to the ACCOBAMS Secretariat, Monaco, February 2002.

Di Beneditto, A.P.M. and R.M.A. Ramos. 2000. Records of the barnacle *Xenobalanus globicipitis* (Steenstrup, 1851) on small cetaceans of Brazil. Biotemas, 13(2): 159–165.

Enfield, D.B. 2001. Evolution and historical perspective of the 1997–1998 El Niño-Southern Oscillation Event. Bull. Mar. Sci., 69(1): 7–25.

Fertl, D. and W.A. Newman. 2008. Barnacles. Pp. 89–91 in Encyclopedia of Marine Mammals. (W.F. Perrin, B. Würsig, and J.G.M. Thewissen, eds.) Academic Press, San Diego, CA.

Grover, J.J., T.W. Buckley, and D. Woodbury. 2002. Effects of the 1997–1998 El Niño on early-juvenile Pacific hake *Merluccius productus*: age, growth, abundance, and diet in coastal nursery habitats. Mar. Ecol. Prog. Ser., 240:235–247.

Kane, E.A., P.A. Olson, T. Gerrodette, and P.C. Fiedler. 2008. Prevalence of the commensal barnacle *Xenobalanus globicipitis* on cetacean species in the eastern tropical Pacific Ocean, and a review of global occurrence. Fish. Bull., 106(4): 395–404.

Karuppiah, S., A. Subramanian, and J.P. Obbard. 2004. The barnacle, *Xenobalanus globicipitis* (Cirripedia, Coronulidae), attached to the bottle-nosed dolphin, *Tursiops truncatus* (Mammalia, Cetacea) on the southeastern coast of India. Crustaceana, 77(7): 879–882.

Kreho, A., N. Kehtarnavaz, B. Araabi, G. Hillman, B. Würsig, and D. Weller. 1999. Assisting manual dolphin identification by computer extraction of dorsal ratio. Ann. Biomed. Eng., 27:830–838.

Mazzoil, M., S.D. McCulloch, R.H. Defran, and M.E. Murdoch. 2004. Use of digital photography and analysis of dorsal fins for photo-identification of bottlenose dolphins. Aquat. Mamm., 30:209–219.

Orams, M.B. and C. Schuetze. 1998. Seasonal and age/size-related occurrence of a barnacle (*Xenobalanus globicipitis*) on bottlenose dolphins (*Tursiops truncatus*). Mar. Mamm. Sci., 14(1): 186–189.

Rajaguru, A. and G. Shantha. 1992. Association between the sessile barnacle *Xenobalanus globicipitis* (Coronulidae) and the bottlenose dolphin *Tursiops truncatus* (Delphinidae) from the Bay of Bengal, India, with a summary of previous records from cetaceans. Fish. Bull., 90(1): 197–202.

Rittmaster, K., N. Bowles, L. Barker, V. Thayer, and D. Odell. 1999. *Xenobalanus* barnacles on *Tursiops* dorsal fins in Beaufort, NC USA. 13th Biennial Conference on the Biology of Marine Mammals, Wailea, Hawaii. 158 pp.

Samaras, W. 1989. New host record for the barnacle *Cryptolepas rhachianecti* Dall, 1872 (Balanomorpha: Coronulidae). Mar. Mamm. Sci., 5(1): 84–87.

Seilacher, A. 2005. Whale barnacles: exaptational access to a forbidden paradise. Paleobiology, 31(2): 27–35.

Speakman, T., E. Zolman, J. Adams, R.H. Defran, D. Laska, L. Schwacke, J. Craigie, and P. Fair. 2006. Temporal and spatial aspects of bottlenose dolphin occurrence in coastal and estuarine waters near Charleston, South Carolina. NOAA Technical Memorandum NOS NCCOS-37, 56 pp.

Spivey, H.R. 1981. Origins, distribution, and zoogeographic affinities of the Cirripedia (Crustacea) of the Gulf of Mexico. J. Biogeogr., 8:153–176.

Toth-Brown, J. and A.A. Hohn. 2007. Occurrence of the barnacle, *Xenobalanus globicipitis*, on coastal bottlenose dolphins (*Tursiops truncatus*) in New Jersey. Crustaceana, 80(10): 1271–1279.

True, F. 1890. Observations on the life history of the bottlenose porpoise. Proc. U.S. Natl. Mus., 812: 197–203.

Van Waerebeek, K., J.C. Reyes, and J. Alfaro. 1993. Helminth parasites and phoronts of dusky dolphins *Lagenorhynchus obscurus* (Gray, 1828) from Peru. Aquat. Mamm., 19(3): 159–169.

Accepted for publication 24 May 2010.

ANNUAL MEETING

SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

May 7–8, 2010

California State University
Los Angeles, CA

Bull. Southern California Acad. Sci.
109(2), 2010, p. 46–48
© Southern California Academy of Sciences, 2010

Future SCAS Meetings

2011 - California Polytechnic University, Pomona, May 6–7
2012 - Occidental College, May 4–5

Acknowledgements

The Southern California Academy of Sciences wishes to acknowledge the following organizations and people for their support of the 2009 Annual Meeting.

THE PORT
OF LOS ANGELES

Special thanks to the SCAS 2010 Annual Meeting Local Committee at California State University, Los Angeles: Phil LaPolt

Student Grants

The Southern California Academy of Sciences supports a program of Grants to graduate students. One stipulation for the winners is that they present their research at the following year's Annual Meeting. This years award winners were

Andres Carrillo, California State University, Fullerton

> **Effects of extended incubation on skeletal development, body shape and feeding rates in the California grunion, *Leuresthes tenuis*.**

Elysse Gatdula, California Polytechnic University, Pomona

> **Molecular biogeography of some California species of Aglajidae (Mollusca: Opisthobranchia)**

Aaron Sappenfield, University of California, Riverside

> **Depositional environments of the Wood Canyon Formation (southern California) and their influence on the distribution and preservation of Ediacaran macrofauna**

STUDENT AWARDS FOR BEST PAPER AND POSTER

Undergraduate or graduate students working towards a degree who elect to participate are eligible for best paper or poster awards in several categories, the categories are;

E – Ecology and Evolution
F – Fishery biology
M – Molecular Biology and physiology
P – Physical Science

The American Institute of Fishery Research Biologists will present the awards in Fishery Biology. The Southern California Academy of Sciences will present the other awards.

2010 SCAS Annual Meeting -Oral Presentation Awardees

PHYSICAL SCIENCES

EVALUATING CONTROLS ON HYDROLOGIC RECOVERY IN BURNED WATERSHEDS IN THE SAN BERNARDINO MOUNTAINS

Alicia M. Kinoshita and Terri S. Hogue. Water Resources and Hydrology, UCLA, Department of Civil and Environmental Engineering, Los Angeles, CA90095.

MOLECULAR BIOLOGY AND PHYSIOLOGY

EFFECTS OF DELAYED HATCHING ON MUSCLE AND SKELETAL DEVELOPMENT, SWIMMING ACTIVITY, AND FEEDING RATE IN LARVAL CALIFORNIA GRUNION, *LEURESTHES TENUIS*

T. Treybig, A. Carrillo, and K. Dickson. California State University Fullerton, Department of Biological Science, Fullerton, CA, 92834.

ECOLOGY AND EVOLUTION

ABUNDANCE, HABITAT USE AND MOVEMENT PATTERNS OF THE SHOVELNOSE GUITARFISH (*RHINOBATOS PRODUCTUS*) IN A SOUTHERN CALIFORNIA ESTUARY

T.J. Farrugia, M. Espinoza and C.G. Lowe. California State University Long Beach, Department of Biological Sciences, Long Beach, CA 90840.

Honorable Mention, Ecology and Evolution

ECOPHYSIOLOGICAL STUDY OF *RUSCUS ACULEATUS* AND *R. MICROGLOSSUM*: MORPHOLOGY, GAS EXCHANGE, AND HYDRAULICS

A. Pivovaroff, R. Sharifi, L. Sack, and P. Rundel. UCLA, Department of Ecology and Evolutionary Biology, Los Angeles, CA, 90095-1606.

STUDENT POSTER AWARD WINNERS

ECOLOGY AND EVOLUTIONARY BIOLOGY

THE EFFECTS OF ILLUMINATION, SCENT, AND MICROHABITAT AS PREDATOR CUES ON THE FORAGING BEHAVIOR OF MOJAVE DESERT RODENTS

Bryan White and Anthony Garcia, Southern California Ecosystems Research Program (NSF-UMEB), California State University Fullerton, Department of Biological Sciences, Fullerton, CA, 92831

FISHERIES BIOLOGY

THE EFFECTS OF OCEANOGRAPHIC VARIABILITY AND FISHING PRESSURE ON FISH POPULATIONS AT ROCKY POINT.

Chelsea Munoz, Mackenzie Hansler, and Drew Hanson. Vantuna Research Group, Occidental College, Department of Biology, Los Angeles, CA, 90041

MOLECULAR BIOLOGY AND PHYSIOLOGY

EFFECTS OF GLUTATHIONE ON DENDRITIC CELL RESPONSE TO *MYCOBACTERIUM TUBERCULOSIS* INFECTION

Brenda Gonzalez [1, 2], Karanjodh Johal [1], Carlos Guerra [1], Alan Cundari [1], John Chan [2] and Vishwanath Venketaraman[1, 2*] [1] California State Polytechnic University, Pomona, CA, [2] College of Osteopathic Medicine of the Pacific, Western University of Health Sciences, CA 92336.

Honorable mention: Molecular biology

THE ESTROGENIC EFFECTS OF DIETHYLSTILBESTROL ON THE MATURATION AND DIFFERENTIATION OF EMBRYONIC THYMOCYTES

Faraj Mourad, University of La Verne, Biology Department, La Verne, CA, 91750

PHYSICAL SCIENCE

NUTRIENT ANALYSIS OF THE BALLONA SALTWATER MARSH, ESTUARY AND CREEK

Dominic Leone and John Dorsey. Santa Monica Bay Restoration Commission, Loyola MaryMount University, Department of Natural Science, Los Angeles, CA, 90045

Bull. Southern California Acad. Sci.
109(2), 2010, pp. 49–51
© Southern California Academy of Sciences, 2010

ALPHABETICAL LIST OF PRESENTERS

Name	Abstract	Judging Category
Alexa Aranjo	124	
Helena Aryafar	56	fisheries
Lizzy Bairstow	63	eco/evo
Hadrian Bansaun	64	mol bio
Jinae Bartlett	117	mol bio
Briana Bergstrom	74	
Hassan Rezaie-Boroon	91,92	
Graciela Brelles-Mariño	39	
Jessica Bruns	65	physical
Megan Burke	7	physical
Donald G. Buth	104	
Susan Cannon	2,66	
Esther Chen	42	
Li Chen	5	
W.B. Chesney	51	
David Cho	93	mol bio
Jeremy T. Claisse	32	
Sieara Claytor	108	eco/evo
Ivan Colburn	67	
Makena Crowe	68	physical
Ann Dalkey	69	
Craig D'Angelo	20	
Stephen D. Davis	14	
Jade Dean	134	eco/evo
Sara Jo Dickens	13	eco/evo
Brian Diep	125	
Dr. Jesse Dillon	37	
Scott Eckart	133	eco/evo
Kyra Engelberg	135	eco/evo
Brad Erisman	35	
Carrie Espasandin	59	eco/evo
Mario Espinoza	58	eco/evo
Thomas Farrugia	60	eco/evo
Alfred Fernandez	17	eco/evo
Michael Ferris	132	eco/evo
Laurel Fink	28	
Tyler Flisik	61	eco/evo
Tom Ford	30	
Erika Fox	62	
Logan Froman	70	eco/evo
Caroline Frost	116	
Genevieve Garcia	71	mol bio
Brian Gatza	109	eco/evo
Martin F. Golden	23	
Brenda Gonzalez	72	mol bio
Jennifer Granneman	27	eco/evo
Margot Griswold	11	
Carlos Guerra	73	
MacKenzie Hansler	84	fisheries
Nora Hall	74	eco evo
Drew Hanson	84	fisheries

Name	Abstract	Judging Category
Ariel Hawley	123	
Mary Helix	48	
Mark Helvey	18	
Jeanette Hendricks	75	eco/evo
Leslie Herington	76	eco/evo
Rebecca Hernandez	77	eco/evo
Katrina Hodges	22	
Ben Higgins	55	eco/evo
Todd M. Hoefen	3	
Steven Hoffman	119	
Julie Huh	128,129	eco/evo
Karina Johnston	52	
Jason Kean	8	
Annemarie Kelleghan	126,131	mol
Alicia Kinoshita	9	physical
John Knapp	12	
Paul R. Krause	26	
Paul Laris	136	
Dan Lawson	19	
Bonnie Lei	78,117	eco/evo
Kenny Lei	118,130	physical
Dominic Leone	79	physical
Suzanne Lewis	110	eco/evo
JoAnne Linnenbrink	102	eco/evo
Tracey Magrann	54	
Sarita Mantravadi	80	mol bio
A Kathryn McEachern	49	
Lauren McKenna	81	eco/evo
Eric Miller	29	
Sumit Mitra	120	
Cassadie Moravek	57	
Chad Morris	82	mol
Faaraj Mourad	83	mol
Chelsia Munoz	84	fisheries
Michelle Murphy	85	eco/evo
Marcia Murry	43	
Jody Noiron	1	
Jessica Ochoa	86	mol bio
Gabriella Orona	87	mol bio
Paul Orwin	38	
Alexandria Pivovaroff	106	eco/evo
Sara Pfremmer	88	eco/evo
Andryus Planutis	101	mol
Louis Plough	25	
Geoff Plumlee	6	
Daniel J. Pondella II	34,47	
Jessamine Quijano	41	mol bio
Gustavo Ramirez	89	mol
Arturo Ramirez-Valdez	90	eco/evo
Donald J. Reish	53	
Kristina Reyes	93	mol bio
Dominique Richardson	107	fisheries
Lauren Saez	21	
Beatrice Saviola	46	
Dean Schafer	94	mol bio

Name	Abstract	Judging Category
Laurine Shahmirian	122	
Sarine Shahmirian	121	
Peter Smolke	95	eco/evo
Don Sortillon	96	mol bio
Tara Stark	16	eco/evo
Benjamin Stava	97	eco/evo
J.R. Steinbeck	50	
Matthew Sutton	15	eco/evo
Marisa Tellez	98	eco/evo
Vaibhav Tiwari	44	
Kent Trego	112–114	
Tracie Treybig	105	mol bio
Vishwanath Venketaraman	45	
Kasthuri Venkateswaran	36	
Lily Verdone	10	
Kevin Wen	127	
Brian White	99	eco/evo
Liz Whiteman	33	
Jonathan Williams	31	
Peter Wohlgemuth	4	
Suh T. Woo	103	eco/evo
Emanuel Zamora	100	mol bio
Michelle Zhao	115	
Anna Zelaya	40	mol bio

Bull. Southern California Acad. Sci.
109(2), 2010, p. 52
© Southern California Academy of Sciences, 2010

SOUTHERN CALIFORNIA ACADEMY OF SCIENCES ANNUAL MEETING

Friday, May 7, 2010, California State University, Los Angeles

Session topic	room	paper numbers	starting time	ending time
Station Fire Watershed Recovery	Alhambra	1–9	8:40	2:00
Coastal Sage Scrub	Alhambra	10–17	2:00	5:00
Sustainable Fisheries	San Gabriel	18–25	8:40	11:20
So. Cal. Rocky Reefs; Preparing for MPA's	San Gabriel	26–35	1:20	5:00
Microbiology: Beyond Human Disease	Montebello	36–46	9:00	4:30
Applications for Long Term Monitoring	Pasadena	47–52	8:50	11:20
Contributed Papers	Pasadena	53–62	1:20	5:00
Poster Session Wine and cheese	Golden Eagle Ballroom	63–100 129–131	5 p.m.	7 p.m.

Saturday, May 8, 2010 California State University, Los Angeles

Session topic	room	Paper numbers	starting time	ending time
Contributed Papers Session 2	Montebello	101–114	9:00	4:20
Research Training Program Session 1	Pasadena	115–128	9:00	4:20
Bridging Science and Education:	Alhambra		8:30	11:20
COSEE West Partnership				
Revisiting long-term studies of Coastal Sage Scrub/grassland boundaries in So. Cal.	Alhambra	132–136	1:20	3:00

Session Breaks 10 AM and 3 PM; coffee, drinks, donuts, etc.

Plenary Speakers:

Friday: Jed Fuhrman, University of Southern California
Changing Views of Marine Microbes

Saturday: Jerry Schubel, Aquarium of the Pacific
"Scientists, Decision-Makers, and the Public: Communicating, Cooperating, and Collaborating".

Friday, May 7, 2010
Location: Alhambra Room

Session: Station Fire Watershed Recovery

Chair: Lisa Northrop, USDA Forest Service

1 8:40 **WILDFIRES AND THEIR AFTERMATH: ASSESSING THE STATION FIRE**
J. Noiron. Angeles National Forest, 701 N. Santa Anita Ave., Arcadia, CA 91006.

2 9:00 **PRELIMINARY EVALUATION OF THE EFFECTIVENESS OF THE EMERGENCY ASSESSMENT OF POSTFIRE DEBRIS-FLOW HAZARDS FOR THE 2009 STATION FIRE (U.S. GEOLOGICAL SURVEY OPEN-FILE REPORT 2009-1227)**
S.H. Cannon, J.E. Gartner, M.N. Hanshaw, J.W. Kean, R.N. Leeper, K.M. Schmidt, and D.M. Staley, U.S. Geological Survey

3 9:20 **POST-WILDFIRE SURFACE MATERIAL MAPPING OF THE STATION FIRE USING AIRBORNE VISIBLE-INFRARED IMAGING SPECTROMETER (AVIRIS) DATA**
T. M. Hoefen (1), R. F. Kokaly (1), R.O. Green (2), G.A. Swayze (1) and G.S. Plumlee (1), (1) U.S. Geological Survey, Denver, CO, 80225, (2) Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, 91109.

4 9:40 **RAINFALL AND PEAK STREAMFLOW FOLLOWING THE STATION FIRE: A BENCHMARK FOR PREDICTIVE MODEL VALIDATION**
P. Wohlgemuth, USDA Forest Service, Forest Fire Laboratory, Riverside, CA, 92507, K. Wright, USDA Forest Service, Sequoia National Forest, Porterville, CA, 93257, T. Hogue, UCLA, Department of Civil and Environmental Engineering, Los Angeles, CA, 90095, P. Robichaud, USDA Forest Service, Forestry Sciences Laboratory, Moscow, ID, 83843, B. Roath, USDA Forest Service, Pacific Southwest Region, Vallejo, CA, 94592, and B. Hill, USDA Forest Service, Pacific Southwest Region, Vallejo, CA, 94592.

10:00–10:20 **BREAK**

5 10:20 **VALIDATION OF POST-FIRE HYDROLOGY MODELS ON A SELECTED SITE IN THE SOUTHWESTERN UNITED STATES**
L. Chen, M. Berli, and K. Chief, Desert Research Institute, 755 East Flamingo Road, Las Vegas, NV 89119.

6 10:40 **ENVIRONMENTAL AND HEALTH-HAZARDS CHARACTERIZATION OF AIRFALL ASH, RESIDUAL ASH, AND SOILS FROM AREAS BURNED BY 2007–2009 SOUTHERN CALIFORNIA WILDFIRES AT THE WILDLAND-URBAN-AGRICULTURAL INTERFACE**
G.S. Plumlee, T.M. Hoefen, S.A. Morman, P.L. Hageman, D.A. Martin, R. Kokaly, R.E. Wolf, H.A. Lowers, J.M. Holloway, W.M. Benzel, G.P. Meeker, and C. Stricker. U.S. Geological Survey, Denver, CO 80225

7 11:00 **ASSESSING THE PHYSICAL AND GEOCHEMICAL IMPACTS OF WIDLFIRE ON AN URBAN FRINGE WATERSHED.**
Megan P. Burke and Terri S. Hogue. Water Resources and Hydrology, UCLA, Department of Civil and Environmental Engineering, Los Angeles, CA 90095.

11:30–12:30 **Plenary Lecture: Theater**
12:30–1:20 **LUNCH BREAK**

8 1:20 **POST-FIRE DEBRIS-FLOW MONITORING IN THE STATION FIRE: INITIAL OBSERVATIONS FROM IN-SITU MEASUREMENTS OF 11 DEBRIS FLOWS**
J.W. Kean and D.M. Staley, U.S. Geological Survey, Denver, CO, 80225

9 1:40 **EVALUATING CONTROLS ON HYDROLOGIC RECOVERY IN BURNED WATERSHEDS IN THE SAN BERNARDINO MOUNTAINS**
Alicia M. Kinoshita and Terri S. Hogue. Water Resources and Hydrology, UCLA, Department of Civil and Environmental Engineering, Los Angeles, CA 90095.

Session: Coastal Sage Scrub Restoration
Location: Alhambra Room

Chair: Ann Dalkey, Palos Verdes Peninsula Land Conservancy

10 2:00 **VEGETATION MAPPING AND CLASSIFICATION OF THE PALOS VERDES NATURE PRESERVE.**
Lily N. Verdone. Palos Verdes Peninsula Land Conservancy, 916 Silver Spur Road, Rolling Hills Estates, CA 90274; lverdone@pvplc.org.

11 2:20 **COASTAL SAGE SCRUB RESTORATION AND REVEGETATION USING A SUCCESSIONAL MODEL**
Margot Griswold, Ph.D., NewFields AER, Restoration Group, Los Angeles, CA 90018

12 2:40 **IN THE WAKE OF WEED MANAGEMENT: ONE STEP FORWARD, TWO STEPS BACK**
J. J. Knapp. Native Range, Incorporated, 4360 East Main Street, Suite A #478, Ventura, California, 93003

3:00–3:20 **BREAK**

13 3:20 **INVASION AND RESTORATION OF COASTAL SAGE SCRUB: ABOVE AND BELOWGROUND FEEDBACKS**
S.J.M. Dickens, E.B. Allen and L.S. Santiago, Department of Botany and Plant Sciences, University of California Riverside, Riverside CA 92521

14 3:40 **COMPARATIVE PHYSIOLOGY BETWEEN COASTAL SAGE AND CHAPARRAL OF THE SANTA MONICA MOUNTAINS**
S.D. Davis[1], A.L. Jacobsen[2], and R.B. Pratt[2]. [1]Pepperdine University, Natural Science Division, Malibu CA, 90263 and [2]California State University, Department of Biology, Bakersfield, CA, 93311.

15 4:00 **EFFECT OF EXOTIC ANNUAL GRASS REMOVAL ON THE RE-ESTABLISHMENT OF COMMON NATIVE OAK UNDERSTORY SPECIES ON SANTA CATALINA ISLAND, CA**
Matthew P. Sutton and Darren R. Sandquist. California State University, Fullerton, Department of Biological Science, Fullerton, CA, 92834-6850.

16 4:20 **LANDSCAPE RESTORATION IN A COASTAL SAGE SCRUB COMMUNITY**
Tara Stark, Dr. Frank Ewers, California State Polytechnic University, Pomona, Biological Sciences Department, Pomona, CA 91768

17 4:40 **DIETARY HABITS OF *CANIS LATRANS* ON THE PALOS VERDES PENINSULA.**
Alfred Fernandez. Palos Verdes Peninsula Land Conservancy, Rancho Palos Verdes, Ca.

5:00 **Poster Session: Golden Eagle Ballroom**

Friday, May 7, 2010
Location: San Gabriel Room

Session: Sustainable Fisheries

Chair: Mark Helvey, NOAA

18 8:40 **THE USE OF CATCH SHARES IN SUSTAINABLE FISHERIES**
M. Helvey, NOAA National Marine Fisheries Service, Sustainable Fisheries Division, Long Beach, California, 90802.

19 9:00 **HOW A SNOUT BECOMES A LAW: CODED WIRE TAGS AND THE ENDANGERED SACRAMENTO RIVER WINTER CHINOOK SALMON**
D. Lawson. National Marine Fisheries Service, Southwest Region, Protected Resources Division, Long Beach, CA, 90802.

20 9:20 **DOLPHIN SAFE LABELING AND THE TUNA TRACKING PROGRAM**
C. D'Angelo. NOAA National Marine Fisheries Service, Southwest Region, Sustainable Fisheries Division, Long Beach, CA 90802

21 9:40 **LARGE WHALE ENTANGLEMENT RISK ASSESSMENT, UNITED STATES WEST COAST**
L. Saez, D. Lawson, S. Wilkin, E. Petras, M. DeAngelis, and C. Fahy. National Marine Fisheries Service, Protected Resources Division, Long Beach, CA, 90802.

10:00–10:20 **BREAK**

22 10:20 **ECONOMIC IMPACT ANALYSIS FOR INFORMING DESIGNATION OF CRITICAL HABITAT FOR THE ENDANGERED LEATHERBACK SEA TURTLE**
C.M. Pinkerton and **K.L. Hodges** (Contractor), National Marine Fisheries Service, Sustainable Fisheries Division, Long Beach, CA, 90802.

23 10:40 **NOAA FISHERIES SERVICE RECREATIONAL FISHERIES DATA COLLECTION PROGRAMS**
M.F. Golden. NOAA Fisheries Service, Long Beach, CA 90802

25 11;00 **IDENTIFICATION OF SEAFOOD SUBSTITUTION IN THE LOS ANGELES MARKETPLACE USING DNA SEQUENCING**
L.V. Plough[1], Anderson, D.[2], and Hedgecock, D.[1]Department of Biological Sciences, University of Southern California, Los Angeles CA, 90089 2 Aquarium of the Pacific, Long Beach, CA, 90802

11:30–12:30 **Plenary Lecture: Theater**
12:30–1:20 **LUNCH BREAK**

Friday, May 7, 2010
Location: San Gabriel Room

Session: Rocky Reefs: Preparing for MPA's

Chair: Robert Grove, Southern California Edison

26 1:20 **PLACEMENT AND EARLY COMMUNITY DEVELOPMENT OF A NEW ARTIFICIAL REEF IN SANTA BARBARA COUNTY, CA**
P.R. Krause, ARCADIS US, Inc. 4640 Admiralty Way, Marina del Rey, CA 90292.

27 1:40 **AN ASSESSMENT OF REEF FISH COMMUNITIES ON ARTIFICIAL AND NATURAL REEFS IN THE SOUTHERN CALIFORNIA BIGHT**
J.E. Granneman and M. Steele. Department of Biology, Northridge, CA, 91330.

28 2:00 **A NEW METHOD TO ASSESS WATER QUALITY AND URBAN IMPACT IN CALIFORNIA ROCKY REEF SYSTEMS: MEASURINGMETAL CONCENTRATIONS IN KELP (*M. PYRIFERA*) SIEVE TUBE SAP.**
L.A. Fink* California State University, Long Beach, 1250 Bellflower Blvd., Long Beach, CA 90840 *Current address: Vantuna Research Group, Occidental College, 1600 Campus Rd., Los Angeles, CA 90041

29 2:20 **RESOURCE-LIMITED REGULATION AND COHERENCE IN OC/SD KELP BEDS: A CASE STUDY OF SAN ONOFRE KELP.**
Eric F. Miller, MBC Applied Environmental Sciences, 3000 Red Hill Ave., Costa Mesa, CA 92626

30 2:40 **KELP, I NEED SOMEBODY**
T.K. Ford, and B.M. Meux. Santa Monica Baykeeper, 120 Broadway, Suite 105, Santa Monica, CA 90401

3;00–3;20 **BREAK**

31 3:20 **GETTING TO KNOW YOUR SOUTH COAST MPAS: NEARSHORE ROCKY REEF ECOLOGY OF POINT VICENTE SMR**
J.P. Williams and D.J. Pondella, II. And Jeremy T.Claisse; Vantuna Research Group, Occidental College, Department of Biology, Los Angeles, CA, 90041.

32 3:40 **LIFE HISTORY INFORMATION CAN IMPROVE UNDERSTANDING OF MPA EFFECTS FOR A VALUABLE FISHERY SPECIES**
J.T. Claisse. Vantuna Research Group, Occidental College, Department of Biology, Los Angeles, CA, 90041.

33 4:00 **REFINING MPA MONITORING TO MEET MLPA REQUIREMENTS**
E.A. Whiteman and C.A. Recchia. MPA Monitoring Enterprise, California Ocean Science Trust, 1330 Broadway, Suite 1135, Oakland, CA 94612

34 4:20 **THE STATUS OF MAINLAND REEFS IN THE SOUTHERN CALIFORNIA BIGHT**
D.J. Pondella, II. Department of Biology and Vantuna Research Group, Moore Laboratory of Zoology, Occidental College, 1600 Campus Rd. Los Angeles, CA 90041

35 4:40 **THE EXISTENCE, IMPORTANCE, AND CONTRIBUTION OF FISH SPAWNING AGGREATIONS TO THE ECOSYSTEMS AND FISHERIES OF THE TEMPERATE WATERS OFF SOUTHERN CALIFORNIA.**
Larry G. Allen[1] and **Brad E. Erisman**[2] [1]Southern California Marine Institute, Terminal Island, CA 2-Scripps Institute of Oceanography, La Jolla, CA

5:00 **Poster Session: Golden Eagle Ballroom**

Friday, May 7, 2010
Location: Montebello Room

Session: Microbiology; Beyond Human Disease

Chair: Graciela Brelles-Marino, California State Polytechnic University

9:00 **INTRODUCTIN TO SYMPOSIA**
Graciela Brelles-Marino

36 9:20 **VIABILITY OF BACILLUS PUMILUS SAFR-032 SPORES AFTER EXPOSING TO SPACE AND SIMULATED MARS CONDITIONS USING EXPOSE EUTEF MODULE**
Kasthuri Venkateswaran. Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA

37 9:40 **UNEXPECTED INCREASES IN MICROBIAL DIVERSITY ALONG A SALINITY GRADIENT IN A SOLAR SALTERN IN BAJA CA, MEXICO**
Jesse Dillon[1], Mark Carlin[1], Andriana-Amparo Gallegos[1], Nathan McLain[1], Shereen Sabet[1,2], [1]California State University, Department of Biological Sciences, Long Beach, CA 90840 [2]Current address: LaSierra University, Department of Biology, Riverside, CA 92515

10:00–10:20 **BREAK**

38 **10:20** **SHOULD I STAY OR SHOULD I GO? INSIGHTS INTO THE PHYSIOLOGICAL ECOLOGY OF *VARIOVORAX PARADOXUS*.**
Paul M. Orwin, California State University San Bernardino, Department of Biology, San Bernardino, CA, 92407.

39 **10:40** **BACTERIAL BIOFILM INACTIVATION BY GAS DISCHARGE PLASMA: AN OVERVIEW.**
Graciela Brelles-Mariño. Biological Sciences Department, California State Polytechnic University, Pomona, CA 91768.

40 **11:00** **BATTLING Pseudomonas BIOFILM WITH GAS DISCHARGE PLASMA**
A. Zelaya[(1)], S. Lwin[(1)], G. Stough[(2)], N. Rad[(2)], K. Vandervoort[(2)], and G. Brelles-Mariño[(2)]. California State Polytechnic University, Pomona, [(1)]Department of Biological Sciences, [(2)]Department of Physics, Pomona, CA, 91768.

11:30–12:30 **Plenary Lecture: Theater**
12:30–1:20 **LUNCH BREAK**

Friday, May 7, 2010
Location: Montebello Room

Session: Microbiology; Beyond Human Disease (cont.)

Chair: Graciela Brelles-Marino, California State Polytechnic University

41M **1:40** **BIOFILM FORMATION OF STAPHYLOCOCCUS EPIDERMIDIS AND PSEUDOMONAS AERUGINOSA ON Ti-6AL-4V AND Ti-6AL-4V-BORON ALLOYS**
Jessamine Quijano[1], Scott Marzano[1], Graciela Brelles-Mariño[1], Vilupanur Ravi[2] and Steve Alas[1]. [1]Department of Biological Sciences and [2]Department of Chemical & Materials Engineering, California State Polytechnic University, Pomona, CA 91768

42 **2:00** **A BACTERIAL SIGNALING PATHWAY CRITICAL FOR A RHIZOBIA-PLANT SYMBIOSIS**
Esther J. Chen[1], Robert F. Fisher[2], Virginia M. Perovich[1], Erich A. Sabio[1], and Sharon R. Long[2]. [1]Department of Biological Science, College of Natural Sciences and Mathematics, California State University Fullerton, Fullerton, CA 92834-6850; [2]Department of Biological Sciences, Stanford University, Stanford, CA 94305-5020.

43 **2:20** **ISOLATION AND CHARACTERIZATION OF OIL-RICH ALGAL STRAINS FOR AGRICULTURAL WASTE WATER TREATMENT AND AS A FEEDSTOCK FOR BIOFUEL PRODUCTION**
Marcia Murry, mmewers@csupomona.edu, Microbiology, College of Science Hossein Ahmadzadeh, mhahmadzadeh@csupomona.edu', Department of Chemistry, Cal Poly Pomona.

44 **2:40** **HERPES SIMPLEX VIRUS TYPE-1 (HSV-1) USES ZEBRAFISH ENCODED 3-*OST*-3 RECEPTOR TO MEDIATE ENTRY AND SPREAD.**
S. Hubbard, and **Tiwari, V**. Western University of Health Sciences, Department of Basic Medical Sciences, Pomona CA, 91766.

3:00–3:20 **BREAK**

45 **3:20** **GLUTATHIONE AND CONTROL OF *MYCOBACTERIUM TUBERCULOSIS* INFECTION**
Dr. VishwanathVenketaraman, Assistant Professor, Western University of Health Sciences, 309 East Second Street, Pomona, CA 91766. USA

46 3:40 **THE NOVEL IDENTIFICATION OF ACIDOCHROMOGENESIS IN NONTUBERCULOUS MYCOBACTERIA**
Beatrice Saviola, Basic Medical Sciences, College of Osteopathic Medicine, Western University of Health Sciences, Pomona, CA, 91767

4:00 **Concluding Remarks,**
Moselio Schaechter Distinguished Professor, emeritus, Tufts University School of Medicine, Boston Adjunct Professor Emeritus, Department of Biology, San Diego State University

5:00 **Poster Session: Golden Eagle Ballroom**

Friday, May 7, 2010
Location: Pasadena Room

SESSION: Applications of Long Term Data Collection Programs

MODERATOR: Mary Elaine Helix, U.S. Minerals Management Service

8:45 **INTRODUCTION**
Mary Elaine Helix, U.S. Minerals Management Service

47 9:00 **STUDYING ROCKY REEFS AND FISHES OF THE SOUTHERN CALIFORNIA BIGHT; FOUR DECADES OF RESEARCH**
D.J. Pondella, II. Department of Biology and Vantuna Research Group, Moore Laboratory of Zoology, Occidental College, 1600 Campus Rd. Los Angeles, CA 90041

48 9:20 **LONG-TERM MONITORING PROGRAM CHALLENGES – MARINe, THE MULTI-AGENCY ROCKY INTERTIDAL NETWORK.**
M.E.Helix. U.S. Minerals Management Service, 1111 Jackson St. Ste. 520 Oakland, CA, 94607

49 9:40 **CLIMATE AFFECTS RESPONSE OF AN ISLAND ENDEMIC PLANT TO REMOVAL OF INVASIVE HERBIVORES**
A. Kathryn McEachern. USGS-WERC, Channel Islands Field Station, 1901 Spinnaker Dr., Ventura, CA 93001. Diane M. Thomson. Claremont Joint Science Department, The Claremont Colleges 925 N. Mills Ave., Claremont, CA 91711. Katherine A. Chess. Colorado Plateau Cooperative Studies Unit, Northern Arizona University, 1298 S. Knowles Ave., Flagstaff, AZ 86001.

10:00–10:20 **BREAK**

50 10:20 **SH%T HAPPENS: HOW DESIGNING REDUNDANCY INTO A MONITORING PROGRAM CAN HELP EXORCISE INTRUDING DEMONS AND INCREASE THE OPTIONS FOR ANALYSIS AND ABILITY TO DETECT CHANGE**
J. R. Steinbeck, Tenera Environmental Inc., 141 Suburban Rd. Suite A2, San Luis Obispo, CA 93401

51 10:40 **DEVELOPMENT OF A SOUTHERN CALIFORNIA REGIONAL EELGRASS MONITORING PROGRAM**
W. B. Chesney. NOAA's National Marine Fisheries Service (NMFS), Habitat Conservation Division, Long Beach, CA, 90802.

52 11:00 **BALLONA WETLANDS BASELINE ASSESSMENT PROGRAM: APPLICATIONS FOR RESTORATION.**
K.K. Johnston and S.P. Bergquist. Santa Monica Bay Restoration Commission, Los Angeles, CA, 90045.

11:30–12:30 **Plenary Lecture: Theater**
12:30–1:20 **LUNCH BREAK**

Friday, May 7, 2010
Location: Pasadena Room

Session: Contributed Papers

Chair: Jonathan Baskin, California State Polytechnic University, Pomona

53 1:20 DISCUSSION OF THE VARIABILITY IN THE POLYCHAETE *Neanthes acuminata* SPECIES COMPLEX: A PROGRESS REPORT
Donald J. Reish[1], Joerg D. Hardege[2], David Lunt[2], Maggy Harley[2] and Ellen J. Storey[2] [1]Department of Biological Sciences, California State University, Long Beach [2]Department of Biological Sciences, Hull University, Hull, United Kingdom

54 1:40 PREVALENCE OF CYANOBACTERIAL TOXINS ALONG A NUTRIENT DISTURBANCE GRADIENT IN SOUTHERN CALIFORNIA LAKES
T. M. Magrann, S. G. Dunbar, PhD, M. Sutula, PhD, and D. Boskovic, PhD, Marine Research Group, Loma Linda University, Department of Earth and Biological Sciences, Loma Linda, CA, 92350.

55E 2:00 FOOD HABITS AND PREY SELECTIVITY OF THE CALIFORNIA GRUNION (*LEURESTHES TENUIS*) IN THE WATER COLUMN NEAR SPAWNING BEACH IN ORANGE COUNTY
B.A. Higgins and M.H. Horn. California State University, Fullerton, Department of Biological Science, Fullerton, CA, 92834.

56F 2:20 DOES DELAYED HATCHING IN THE CALIFORNIA GRUNION, *LEURESTHES TENUIS*, AFFECT LARVAL SURVIVAL?
Helena Aryafar and Kathryn Dickson, California State University Fullerton, Department of Biological Science, 800 N. State College Blvd. Fullerton CA 92834-6850

57 2:40 HETEROCHRONY IN DEVELOPMENT DURING EXTENDED INCUBATION IN CALIFORNIA GRUNION
C. L. Moravek and K. L. Martin. Pepperdine University, Department of Biology, Malibu, CA 90263-4321.

3:00–3:20 BREAK

58E 3:20 INFLUENCE OF WATER TEMPERATURE ON SITE FIDELITY AND HABITAT USE OF GRAY SMOOTH-HOUND SHARKS IN A NEWLY RESTORED ESTUARINE HABITAT
M. Espinoza, T. Farrugia and C. Lowe. California State University, Long Beach, Department of Biological Sciences, Long Beach, CA, 90040.

59E 3:40 FINE SCALE MOVEMENT PATTERNS OF THE CALIFORNIA HALIBUT, *PARALICHTHYS CALIFORNICUS*, IN A NEWLY RESTORED SOUTHERN CALIFORNIA ESTUARY
C. L. Espasandin, E. Fox, C. Whitcraft, B. Allen and C. G. Lowe, California State University, Long Beach, Department of Biological Sciences, Long Beach, CA 90840

60E 4:00 ABUNDANCE, HABITAT USE AND MOVEMENT PATTERNS OF THE SHOVELNOSE GUITARFISH (*RHINOBATOS PRODUCTUS*) IN A SOUTHERN CALIFORNIA ESTUARY
T.J. Farrugia, M. Espinoza and C.G. Lowe. California State University Long Beach, Department of Biological Sciences, Long Beach, CA 90840.

61E 4:20 EFFECTS OF A PARTIAL DIET OF PIPEFISH, A LOW-QUALITY PREY, ON THE GROWTH OF CAPTIVE ELEGANT TERN CHICKS
T J. Flisik and M. H. Horn, Department of Biological Science, California State University, Fullerton, 800 N. State College Blvd., Fullerton, CA, 92831-3599.

62 4:40 TEMPORAL AND SPATIAL PATTERNS IN ABUNDANCE AND DIVERSITY OF FISH ASSEMBLAGES IN A NEWLY RESTORED SOUTHERN CALIFORNIA COASTAL WETLAND.
E.J. Fox, C.L. Espasandin, C. Whitcraft, C.G. Lowe, and B.J. Allen. California State University, Long Beach, Department of Biological Sciences, Long Beach, CA, 90840.

5:00 Poster Session: Golden Eagle Ballroom

Friday, May 7, 2010 5 p.m.
Location: Golden Eagle Ballroom

Session: Poster Session

63E **SEASONAL AND TIDAL VARIATION OF FECAL INDICATOR BACTERIA IN THE BALLONA WETLANDS, LOS ANGELES COUNTY, CALIFORNIA**
Lizzy Bairstow, and Karina Johnston. The Center for Santa Monica Bay Studies, Loyola Marymount University, Department of Natural Science, Los Angeles, CA 90045.

64M **THE EFFECTS OF DELAYED HATCHING ON SKELETAL AND MUSCLE DEVELOPMENT IN LARVAE OF THE CALIFORNIA GRUNION, *LEURESTHES TENUIS***
H. Bansuan, J. Masumi, A. Miranda, T. Treybig, and K.A. Dickson, California State University Fullerton, Department of Biological Science, Fullerton, CA, 92834.

65P **TECTONIC IMPLICATIONS OF BASALTIC VOLCANISM IN THE OWENS VALLEY, CALIFORNIA**
Jessica J. Bruns and David R. Jessey. Geological Sciences Dept., California Polytechnic University – Pomona, Pomona, CA 91768.

66 **SCIENCE IN SUPPORT OF COMMUNITY RESILIENCY: THE U.S. GEOLOGICAL SURVEY MULTI HAZARDS DEMONSTRATION PROJECT RESPONSE TO THE 2009 STATION FIRE**
S.H. Cannon, R.N. Fisher, M.N. Hanshaw, T.M. Hoefen, L.M. Jones, J.W. Kean, S.C. Perry, G.S. Plumblee, K.M. Schmidt, and D.M. Staley. U.S. Geological Survey.

67 **GRAIN SIZE ANALYSIS AND MECHANICS OF THE 2008 MOUNT WHITNEY FISH HATCHERY MUDFLOW ON THE EASTERN SLOPE OF THE SIERRA NEVADA, INDEPENDENCE, CALIFORNIA**
Ivan P. Colburn Department of Geological Sciences, California State University Los Angeles, Los Angeles, California 90032

68P ***EQUUS* MATERIAL FROM THE LA HABRA FORMATION, RALPH B. CLARK REGIONAL PARK, BUENA PARK, ORANGE COUNTY, CALIFORNIA.**
M.K. Crowe and L. Babilonia, Ralph B. Clark Regional Park, Interpretive Center, 8800 Rosecrans Ave. Buena Park, CA, 90621.

69 **TEMPORAL AND SPATIAL TRENDS MICROCLIMATE FOR THREE SPECIES OF COASTAL SAGE SCRUB ON THE PALOS VERDES PENINSULA.**
Dalkey[1], A., T. Burns[2], and D. Huh[3]. [1]Palos Verdes Peninsula Land Conservancy, Rolling Hills Estates, CA, 90274; [2]Long Beach Polytechnic High School, Long Beach, CA, 90813; [3]Palos Verdes Peninsula High School, Rolling Hills Estates, CA 90274.

70E **IS A NEWLY DISCOVERED CHITON BROODER ON SANTA CATALINA ISLAND AN UNDESCRIBED SPECIES?**
L. D. Froman and D. J. Eernisse, Cal State Fullerton, Department of Biology, Fullerton, CA, 92834-6850

71M **BIOLOGICAL ACTIVITY: THE IMPORTANCE OF FUNCTIONAL GROUPS ON (E)-4,4'-DISUBSTITUTED STILBENES TOWARDS CELL PROTECTION.**
G.X. Garcia, S.W. Larsen, C. Pye, R. Isovitsch, and E.A. Fradinger. Whittier College, Departments of Biology and Chemistry, Whittier, CA, 90608.

72M **EFFECTS OF GLUTATHIONE ON DENDRITIC CELL RESPONSE TO *MYCOBACTERIUM TUBERCULOSIS* INFECTION**
Brenda Gonzalez [1, 2], Karanjodh Johal [1], Carlos Guerra [1], Alan Cundari [1], John Chan [2] and Vishwanath Venketaraman[1, 2*] [1]California State Polytechnic University, Pomona, CA, [2]College of Osteopathic Medicine of the Pacific, Western University of Health Sciences, CA 92336.

73 **COMPONENTS OF INNATE IMMUNITY AND ADAPTIVE IMMUNITY IN COOPERATION WITH INCREASED GLUTATHIONE LEVELS AGAINST *MYCOBACTERIUM TUBERCULOSIS* INFECTED MONOCYTES**
Vishwanath Venketaraman[1, 2*], Karanjodh Johal [1], Brenda Gonzalez [1] **and Carlos Guerra** [1]Western University Of Health Sciences, College Of Osteopathic Medicine Of The Pacific, Department Of Basic Medical Sciences, Pomona, CA, 91766

74E **ASSESSMENT OF FLORAL AND INSECT BIODIVERSITY OF BALLONA WETLANDS**
N.M. Hall and B.T. Bergstrom, Santa Monica Bay Restoration Commission, Loyola Marymount University, Department of Natural Science, Los Angeles, CA, 90045

75E **PREY DELIVERED BY THE CALIFORNIA LEAST TERN TO ITS NESTING COLONY AT THE SEAL BEACH NATIONAL WILDLIFE REFUGE, 1996-2009.**
Michael Horn[1], Charles Collins[2], and **Jeanette Hendricks**[1], [1]Department of Biological Science, California State University Fullerton, 800 North State College Blvd, Fullerton, CA 92834. [2]Department of Biological Sciences, California State University, Long Beach, 1250 Bellflower Blvd, Long Beach, CA 90840.

76E **RODENT COMMUNITY STRUCTURE AND MICROHABITAT ASSOCIATIONS AT THE BERNARD FIELD STATION, CLAREMONT, CALIFORNIA.**
L.A. Herington, L. Bledsoe, L. Davis, A. Degrassi, J. Edwards, P. Gonzalez, C. Hauser, B. Kronenfeld, J. Lee, C. Mirzaian, T. Oberg, E. Ortiz, E. Peralta, T. Sterner, T. Treybig and P. Stapp. Department of Biological Science, California State University, Fullerton, CA 92831.

78E **CRYPTIC SPECIES AND SYNONYMS: A RECLASSIFICATION OF THE TROPICAL SPURILLA GENUS**
Bonnie R. Lei. Walnut High School, 400 North Pierre Road, Walnut, CA 91789. Department of Biological Sciences, California State Polytechnic University, Pomona, 3801 West Temple Avenue, Pomona, CA 91768-4032.

79P **NUTRIENT ANALYSIS OF THE BALLONA SALTWATER MARSH, ESTAUARY AND CREEK**
Dominic Leone and John Dorsey. Santa Monica Bay Restoration Commission, Loyola MaryMount University, Department of Natural Science, Los Angeles, CA, 90045

80M **REVIEW OF ETIOLOGY, HISTOPATHOLOGY, IMMUNOHISTOCHEMISTRY AND DIAGNOSTIC TOOLS FOR SJÖGRENS SYNDROME.**
Sarita S. Mantravadi, CSU Dominguez Hills

81E **METHODS FOR SAMPLING LARGE AND MEDIUM MAMMALS IN BALLONA WETLANDS**
McKenna, Lauren, Karina Johnston, and John Dorsey, Loyola Marymount University, Natural Science Department, Los Angeles, CA 90045.

82M **EXAMINING MULTIPLE AGO GENE CONSTRUCTS IN THE PRESENCE OF P0 TO OBSERVE THE ABILITY OF P0 TO TARGET AGO FOR DEGRADATION**
Chad Morris, CSU Fullerton

83M **THE ESTROGENIC EFFECTS OF DIETHYLSTILBESTROL ON THE MATURATION AND DIFFERENTIATION OF EMBRYONIC THYMOCYTES**
Faraj Mourad, University of La Verne, Biology Department, La Verne, CA, 91750

84F **THE EFFECTS OF OCEANOGRAPHIC VARIABILITY AND FISHING PRESSURE ON FISH POPULATIONS AT ROCKY POINT.**
Chelsea Munoz, Mackenzie Hansler, and Drew Hanson. Vantuna Research Group, Occidental College, Department of Biology, Los Angeles, CA, 90041

85E **EVALUATING WILDLIFE CORRIDOR LINKAGES: DO FREEWAY UNDERPASSES CONNECT THE PENINSULAR AND TRANSVERSE MOUNTAIN RANGES?**
L. Murphy, M.F. Allen, and C.W. Barrows. Center for Conservation Biology, University of California, Riverside, CA 92521-0334, USA.

86M **ADMINISTRATION OF DAIDZEIN, A SOYA DERIVED PHYTOESTROGEN, IS CORRELATED WITH AN INCREASE IN LIFESPAN WITHIN THE NEMATODE *C. ELEGANS***
J. M. Ochoa and S.A. Vetrone, Biology Department, Whittier College, Whittier, CA 90608

87M **EARLY DEVELOPMENTAL EXPOSURE TO CHLORPYRIFOS AFFECTS THE CHOLINERGIC NERVOUS SYSTEM OF THE ZEBRAFISH.**
G. Orona, F. Radoniqi, S. Han, and E.A. Fradinger. Whittier College, Department of Biology, Whittier, CA, 90608.

88E **THE EFFECTS OF THERMAL STRESS ON FILTRATION RATES OF NON-NATIVE *CRASSOSTREA GIGAS* AND NATIVE *OSTREA LURIDA* OYSTERS**
Sara Pfremmer and Patricia Gonzalez, Southern California Ecosystems Research Program (NSF-UMEB), California State University Fullerton, Department of Biological Sciences, Fullerton, CA, 92831

89M **EARLY ONSET OF THE LEGUME-RHIZOBIA SYMBIOSIS: DETECTION OF EARLY NODULIN GENE ACTIVITY IN *M.* truncatula SEEDS FOLLOWING NOD FACTOR EXPOSURE.**
G. A. Ramirez, B. Boschetto and G. Brelles-Mariño, California State Polytechnic University, Pomona, Biological Sciences Department, Pomona, CA, 91768.

90E **ECOLOGY AND BIOGEOGRAPHY OF THE ROCKY INTERTIDAL FISH COMMUNITY IN THE WESTERN COAST OF THE BAJA CALIFORNIA PENINSULA**
Ramírez-Valdez, A.[1], G. Ruiz-Campos[2], F. Correa-Sandoval[3] and E. Carpizo-Ituarte[3]. [1]Facultad de Ciencias Marinas, Universidad Autónoma de Baja California, Km. 103 Carr. Tijuana-Ensenada, AP 653, Ensenada, Baja California, 22800, México. [2]Colección Ictiológica, Facultad de Ciencias, Universidad Autónoma de Baja California, Km. 103 Carr. Tijuana-Ensenada, AP 233, Ensenada, Baja California, 22800, México. [3]Instituto de Investigaciones Oceanológicas, Universidad Autónoma de Baja California, Carr. Tijuana-Ensenada Km. 107, Ensenada, Baja California., México. 22890.

91 **GEOCHEMISTRY AND METALS DISTRIBUTION IN SEDIMENTS OF SOUTHERN TOGO RIVERS WATERSHED, WEST AFRICA**
Rezaie-Boroon, M.H., California State University Los Angeles, Geological Sciences Department, CA 90032, mrezaie@calstatela.edu Gnandi, K., University of Lomé, Science Department, Lomé, Togo, West Africa, kgnandi@yahoo.fr Tomety-Mensah Folly, K., University of Lomé, Science Department, Lomé, Togo, West Africa tomensfol@yahoo.fr

92 **GEOCHEMISTRY AND SEDIMENTOLOGY OF EOCENE PHOSPHATE DEPOSITS IN WEST AFRICA**
Rezaie-Boroon, M.H., California State University Los Angeles, Geological Sciences Department, CA 90032, mrezaie@calstatela.edu Ramirez, P., California State University Los Angeles, Geological Sciences Department, CA 90032, pramire@calstatela.edu Gnandi, K., University of Lomé, Science Department, Lomé, Togo, West Africa, kgnandi@yahoo.fr

93M **A STUDY OF MICROBIAL MAT CONIFORM STRUCTURES FOUND IN OCTOPUS SPRING, YELLOWSTONE NATIONAL PARK**
Kristina Reyes, David Cho, Nahal Ghahremani, and Hope A. Johnson, California State University, Fullerton, Department of Biology, Fullerton, CA 92831

94M **LOSS OF VIRAL RESISTANCE RECOGNITION THROUGH MUTAGENESIS OF THE SILENCING SUPRESSPOR P0.**
D.S. Schafer and M. Sacco. Sacco Research Lab, California State University, Fullerton, Department of Biology, Fullerton, CA, 92831.

95E **THE EFFECT OF WILDFIRE UPON WILD CANID VISITATION TO THE PORTUGUESE BEND NATURE PRESERVE**
Peter Smolke[1], Alfred Fernandez[2], Ann Dalkey[3]. [1]Palos Verdes Peninsula High School, Rolling Hills Estates, CA90274; [2]Harbor City College, Long Beach, CA, 90813; Palos Verdes Peninsula Land Conservancy, Rolling Hills Estates, CA, 90274.

96M **INVESTIGATION OF THE EFFECTS OF METHOXYCHLOR METABOLITE, HPTE, ON EMBRYONIC DEVELOPMENT OF T-CELLS IN C57BL/6**
Dr. Christine Broussard and **D.M. Sortillon**, University of La Verne, Department of Biology, La Verne, CA, 91750

97E **HERPETOFAUNA SURVEYS IN THE BALLONA WETLANDS**
Benjamin Stava, Loyola Marymount University.

98E **PARASITIC INFECTION OF THE VENTRAL EPIDERMIS OF *CROCODYLUS ACUTUS* AND *CROCODYLUS MORELETII* IN BELIZE**
M. Tellez[1] and I. Paquet-Durand[2] [1]Department of Ecology and Evolutionary Biology, University of California, Los Angeles, California, 90095-1606, U.S.A. [2]Galen University, 62.5 Western Highway, San Ignacio, Cayo District, Belize.

99E **THE EFFECTS OF ILLUMINATION, SCENT, AND MICROHABITAT AS PREDATOR CUES ON THE FORAGING BEHAVIOR OF MOJAVE DESERT RODENTS**
Bryan White and Anthony Garcia, Southern California Ecosystems Research Program (NSF-UMEB), California State University Fullerton, Department of Biological Sciences, Fullerton, CA, 92831

100M **THE EFFECT OF CO-ADMINSTRATION OF GENISTEIN AND DAIDZEIN ON THE LIFESPAN OF THE NEMATODE *C. ELEGANS*.**
E.D. Zamora and S.A. Vetrone

129E **DYNAMICS OF FECAL INDICATOR AND OTHER BACTERIA DURING VARYING TIDAL CONDITIONS IN DEL REY LAGOON, PLAYA DEL REY, CALIFORNIA**
J.J. Huh, J.T. Valdez, J. Dorsey. Leonetti-O'Connell Honors Research in Science, Loyola Marymount University and Marlborough School, Department of Natural Sciences, Los Angeles, CA, 90015 and 90004.

130P **IMPROVING ELEVATOR SCHEDULING EFFICIENCY BY IMPLEMENTING A SMARTER CONTROLLER**
Kenny Lei. Walnut High School, 400 N. Pierre Road, Walnut, CA 91789. California State Polytechnic University, Pomona, 3801 W. Temple Avenue, Pomona, CA 91768.

131M **AN INVESTIGATION OF RADIOISOTOPES AND E.COLI LEVELS IN SANTA MONICA BEACH**
A. R. Kelleghan. Notre Dame Academy, Los Angeles, CA and University of Southern California, Los Angeles, CA

Saturday, May 8, 2010
Location: Montebello Room

Session: Contributed papers

Chair: Brad Blood: Psomas

101M 9:00 **RECURRENCE REGULATION IN COLON CANCER: EXTRACELLULAR WNT SIGNALING DETERMINES RECURRENCE POTENTIAL THROUGH REDUCTION OF THE CLONOGENIC CELLS NUMBER BY INHIBITORS DKK1 AND SFRP1**
A. Planutis, Dr. Holcombe's Lab, Hematology/Oncology, Department of Medicine, University of California, Irvine, CA, 92697.

102E 9:20 **A STUDY OF RECENT GENETIC BOTTLENECTS USING INVASIVE GOBIES, *TRIDENTIGER BARBATUS* AND *TRIDENTIGER BIFASCIATUS*, IN SAN FRANCISCO BAY SUGGESTS A TEMPORALLY SHORT RECOVERY PERIOD**
JoAnne Linnenbrink and Raymond R. Wilson, Jr. California State University Long Beach, Department of Natural Sciences, Long Beach, CA, 90804

103E 9:40 **PHENOLOGICAL AND PHYSIOLOGICAL RESPONSE OF AN INVASIVE SPECIES *CENTUAREA MELINTENSIS* UNDER DIFFERENT AMOUNTS OF SOIL NITROGEN SUPPLY**
S.Y. Woo, J. Moroney, R. Sharifi, and P.W. Rundel. University of California, Los Angeles, Department of Ecology and Evolutionary Biology

10:00–10:20 **BREAK**

104 10:20 **SHOULD MITOCHONDRIAL DNA SEQUENCES BE USED IN PHYLOGENETIC STUDIES?**
Donald G. Buth, Dept. of Ecology an d Evolutionary Biology, University of California (UCLA), Los Angeles, CA 90095-1606

105M 10:40 **EFFECTS OF DELAYED HATCHING ON MUSCLE AND SKELETAL DEVELOPMENT, SWIMMING ACTIVITY, AND FEEDING RATE IN LARVAL CALIFORNIA GRUNION, *LEURESTHES TENUIS***
T. Treybig, A. Carrillo, and K. Dickson. California State University Fullerton, Department of Biological Science, Fullerton, CA, 92834.

106E 11:00 **ECOPHYSIOLOGICAL STUDY OF *RUSCUS ACULEATUS* AND *R. MICROGLOSSUM*: MORPHOLOGY, GAS EXCHANGE, AND HYDRAULICS**
A. Pivovaroff, R. Sharifi, L. Sack, and P. Rundel. UCLA, Department of Ecology and Evolutionary Biology, Los Angeles, CA, 90095-1606.

11:30–12:30 **Plenary Lecture: Theater**
12:30–1:20 **LUNCH BREAK**

Saturday, May 8, 2010
Location: Montebello Room

Session: Contributed papers (cont.)

Chair: Brad Blood, Psomas

107F 1:20 **INCORPORATING ANIMAL BEHAVIOR AND ENVIRONMENTAL EDUCATION INTO CONSERVATION BIOLOGY**
D. T. Richardson. Narguizian Lab, California State University, Los Angeles, Department of Biological Sciences, Los Angeles, CA, 90032

108E 1:40 **GENETIC VARIATION IN POPULATIONS OF THE INTRODUCED EASTERN FOX SQUIRREL (*SCIURUS NIGER*) IN CALIFORNIA**
S. Claytor, A. Muchlinski, and E. Torres. California State University-Los Angeles, Department of Biological Sciences, Los Angeles, CA 90032

109E 2:00 **THE EASTERN FOX SQUIRREL AS AN INVASIVE SPECIES: APPEARANCE AT RANCHO SANTA ANA BOTANIC GARDEN, CLAREMONT, CA**
B. Gatza and A. Muchlinski. California State University-Los Angeles, Department of Biological Sciences, Los Angeles, CA 90032

110E 2:20 **FACTORS THAT ALLOW THE NATIVE WESTERN GRAY SQUIRREL (*SCIURUS GRISEUS*) AND THE INTRODUCED EASTERN FOX SQUIRREL *(SCIURUS NIGER)* TO COEXIST IN CERTAIN HABITATS WITHIN SOUTHERN CALIFORNIA**
S. M. Lewis and A. E. Muchlinski. California State University-Los Angeles, Department of Biological Sciences, Los Angeles, CA 90032

111M 2:40 **CHANGING SEXES IN A COMPLEX ENVIRONMENT - SHIFTS IN SKELETAL MYOSIN ISOFORMS IN COASTAL POPULATIONS OF CALIFORNIA SHEEPHEAD**
J.N. Bartlett, K.M. Loke, K.Young, C. Lowe and B.C. Rourke. California State University, Long Beach, Department of Biological Sciences, Long Beach, CA 90840.

3:00–3:20 **BREAK**

112 3:20 **VENUS: EARTH'S TWIN PLANET AND ABSENCE OF SURFACE OCEANS**
Kent D. Trego, Center for Planetary Oceans, Nautilus Oceanic Institute, La Jolla, California 92037

113 3:40 **CONSIDERATION OF INTERNAL OCEANS IN THE MOONS OF SATURN AFTER THE CASSINI MISSION**
Kent D. Trego, Center for Planetary Oceans, Nautilus Oceanic Institute, La Jolla, California 92037

114 4:00 **THE DWARF PLANET CERES AND THE POSSIBILITY OF OF AN INTERNAL OCEAN**
Kent D. Trego, Center for Planetary Oceans, Nautilus Oceanic Institute, La Jolla, California 92037

SATURDAY, May 8, 2010
Location: Pasadena Room

Session: Research Training Program

Chair: Gloria Takahashi La Habra High School

115 9:00 **COMPARISON OF THE EFFECTIVENESS OF TRANSCUTANEOUS ELECTRICAL NERVE STIMULATION AND ACUPUNCTURE ON LOWER BACK PAIN**
Michelle Zhao 4911 Maplewood Avenue LA, CA 90004

116 9:20 **REDUCING POLLUTION THROUGH GREEN ROOFS: A PHOTOSYNTHETIC STUDY.**
C. A. Frost. Drennan Biology Lab, Loyola Marymount University, Department of Biology, Los Angeles, CA.

117 9:40 **HIDDEN IN PLAIN SIGHT: IDENTIFICATION AND DESCRIPTION OF A NEW SPECIES OF *SPURILLA* WITH A PROPOSED MECHANISM OF SPECIATION**
Bonnie R. Lei. Walnut High School, 400 North Pierre Road, Walnut, CA 91789. Department of Biological Sciences, California State Polytechnic University, Pomona, 3801 West Temple Avenue, Pomona, CA 91768-4032.

10:00–10:20 **BREAK**

118 10:20 **AUTONOMOUS ROBOT MODELING OF BACTERIAL MOTION AND CHEMOTAXIS**
Kenny Lei. Walnut High School, 400 N. Pierre Road, Walnut, CA 91789. Harvey Mudd College, 301 Platt Boulevard, Claremont, CA 91711

119 10:40 **DETECTING ANTIBIOTIC INSENSITIVITIES IN WETLAND BACTERIA**
Steven Hoffman, Research Training Program.

120 11:00 **THE EFFECT OF PHOTOSENSITIZATION OF FULLERNE-BASED NANOPARTICLES ON REACTIVE OXYGEN SPECIES GENERATION AND TOXICITY TO VIRUSES IN VARIOUS AQUEOUS ENVIRONMENTS**
Sumit Mitra, University High School, Irvine, CA 92612, Research with: Center for Environmental Implications of Nanotechnology, Duke University, Durham, NC

11:30–12:30 **Plenary Lecture: Theater**
12:30–1:20 **LUNCH BREAK**

SATURDAY, May 8, 2010
Location: Pasadena Room

Session: Research Training Program (cont.)

Chair: Dr. Martha Schwartz

121 1:20 **PROPARGYL METHYL ETHERS: NOVEL PRECURSORS TO COBALT-COMPLEXED PROPARGYL CATIONS**
Sarine Shahmirian and Gagik G. Melikyan. California State University Northridge, Department of Chemistry and Biochemistry, Northridge, CA, 91330

122 1:40 **ROLE OF SACCHARIDES IN THE IDENTIFICATION OF *SACCHAROMYCES CEREVISIAE* CLUMPING**
Laurine J. Shahmirian and Steven B. Oppenheimer. California State University Northridge, Department of Biology and Center for Cancer and Developmental Biology, Northridge, CA, 91330.

123 2:00 **THE EFFICIENCY OF'DIET AND EXERCISE COMBINED TO CONTROL TYPE 2 DIABETES VERSUS METFORMIN ALONE, DIET ALONE, EXERCISE ALONE, OR A COMBINATION OF METORMIN AND EXERCISE.**
Ariel J. Hawley, Palos Verdes High School, Palos Verdes Estates, CA, 90274.

124 2:20 **THE EFFECT OF LICORICE ON THE MOUSE HIPPOCAMPUS**
Alexa Aranjo. University of Southern California, Department of Biological Sciences, Neurology and Biomedical Engineering, Los Angeles, CA 90089.

125 2:40 **MITOCHONDRIAL ACTIVITY AND AUTOPHAGY RESPONSE IN MYOBLASTS**
Brian Diep[1] and Toshifumi Tomoda[2] [1]San Gabriel High School, [2]Beckman Research Institute of City of Hope

3:00–3:20 **BREAK**

126 3:20 **AN ANALYSIS OF COLIFORM BACTERIA LEVELS IN THE BALLONA CREEK**
A. R. Kelleghan Notre Dame Academy, Los Angeles, CA and University of Southern California, Los Angeles, CA

127 3:40 **CARBON SEQUESTRATION WITHIN AN ACRE OF *RHUS INTEGRIFOLIA***
Kevin Wen, Palos Verdes Peninsula High School

128 4:00 **UNDERSTANDING THE CALIFORNIA WATER SHORTAGE AND LOCALIZING THE ISSUE FOR MARLBOROUGH SCHOOL**
J.J. Huh, Marlborough School, Department of Natural Sciences, Los Angeles, CA, 90004.

SATURDAY, May 8, 2010
Location: Alhambra Room

Session: Bridging Science and Education: COSEE West Partnerships

Chair: Gwen Noda, COSEE-West

8:30 **Coffee, snacks and networking (sponsored by COSEE-West)**

9:00 **WHAT ARE COSEE & COSEE-WEST? WHAT DO WE DO? HOW CAN YOU BE INVOLVED (scientists & educators)?**
G.K. Noda, COSEE-West, University of California Los Angeles, Department of Ecology and Evolutionary Biology, Los Angeles, CA, 90095 and **L. Chilton**, COSEE-West and USC Sea Grant, University of Southern California, USC Sea Grant Program, Los Angeles, CA, 90089

9:20 **HOW ATTENDING SCIENTIFIC CONFERENCES CAN BENEFIT YOUR CLASSROOM**
G.K. Noda, COSEE-West, University of California Los Angeles, Department of Ecology and Evolutionary Biology, Los Angeles, CA, 90095 and **L. Chilton**, COSEE-West and USC Sea Grant, University of Southern California, USC Sea Grant Program, Los Angeles, CA, 90089

9:40 **ABCS OF SCIENTIFIC CONFERENCES (FOR FIRST TIMERS!)**
G.K. Noda, COSEE-West, University of California Los Angeles, Department of Ecology and Evolutionary Biology, Los Angeles, CA, 90095 and **L. Chilton**, COSEE-West and USC Sea Grant, University of Southern California, USC Sea Grant Program, Los Angeles, CA, 90089

10:00 **COFFEE BREAK**

10:20 **SCIENTISTS REACHING INTO CLASSROOMS: SCIENTIST PANEL SHARING HOW THEY ARE ABLE TO SUPPORT BY PRESENTING CURRENT RESEARCH TO THE CLASSROOM TEACHER FOR INCORPORATION IN THE CURRICULUM.**
J. KALMAN, Exhibits and Collections Curator, Cabrillo Marine Aquarium **S. BAY**, Principal Scientist, Southern California Coastal Water Research Project (SCCWRP)

10:40 **TEACHERS CONNECTING THEIR STUDENTS TO SCIENCE: TEACHER PANEL SHARING HOW THEY UTILIZE CW RESOURCES AND INCORPORATE CURRENT MARINE SCIENCES INTO THEIR CLASSROOMS**
D. DECK, Stephen Foster Elementary School, Lakewood, CA **L. ESCAJEDA**, Marina del Rey Middle School Marine Science Academy, Los Angeles, CA **M. FRIEDMAN**, Animo Leadership Charter High School, Inglewood, CA

11:00 **NETWORKING: TALK WITH COSEE WEST PRESENTERS AND STAFF TO PLAN COLLABORATIONS, FIND SOLUTIONS AND EXPLORE OPPORTUNITIES**
COSEE-West Staff

11:30–12:30 **Plenary Lecture: Theater**

12:30–1:20 **LUNCH BREAK**

SATURDAY, May 8, 2010
Location: Alhambra Room

Session: Revisiting long-term studies of Coastal Sage Scrub/grassland boundaries in Southern California

Chair: Paul Laris, CSU Long Beach

132E 1:20 MAPPING FIFTY YEARS OF VEGETATION CHANGE AT PORTUGUESE BEND
M.H. Ferris, California State University, Long Beach, Department of Geography, Long Beach, California 90840

133E 1:40 LOOKING BACK AT CHANGES IN COASTAL SAGE SCRUB BOUNDARIES IN THE SANTA MONICA MOUNTAINS, AGAIN
Scott Eckardt, Samantha Roth & Paul Laris, California State University, Long Beach, Department of Geography, Long Beach, California 90840

134E 2:00 AN 80 YEAR RECORD OF THE DISTURBANCE REGIME OF CALIFORNIA COASTAL SAGE SCRUB ON THE PALOS VERDES PENINSULA
Jade Dean*, Paul Laris, Chrys Rodrigue and Michael Ferris California State University, Long Beach, Department of Geography, Long Beach, California 90840

135E 2:20 REVISITING THE LONG TERM IMPACTS OF MECHANICAL DISTURBANCES, GRAZING AND FIRE ON CSS/GRASSLAND BOUNDARIES IN MUGU STATE PARK, CALIFORNIA
Kyra Engelberg*[1], Paul Laris[1], and Samantha Roth[1] 1: University of California, Long Beach

136 2:40 REVISITING LONG-TERM STUDIES OF GRASSLAND/WOODLAND BOUNDARIES: WHAT WE CAN LEARN?
Paul Laris (CSU Long Beach)

2010 ABSTRACTS IN PROGRAM ORDER

1. WILDFIRES AND THEIR AFTERMATH: ASSESSING THE STATION FIRE

J. Noiron. Angeles National Forest, 701 N. Santa Anita Ave., Arcadia, CA 91006.

An overview of the 2009 Station Fire, which burned nearly one-fourth of the Angeles National Forest and was the largest fire in the County's history. The arson fire destroyed 102 homes, cabins, and other structures. Two firefighters died when their vehicle went off a cliff. Hidden in these statistics is the toll to native plant and animal species that has occurred and the likely threat of even more damage from debris flow and soil erosion because of winter rains. The sheer size of the Station fire is making recovery and prevention of further damage extremely challenging. It will take many years for the watersheds in the Angeles National Forest to recover. Until then, interagency collaborative efforts and volunteer are essential to protect natural and cultural resources from further damage. Postfire recovery actions are focusing on protecting infrastructure, stabilizing ecosystems, reducing risk of invasive species spread, and restoring 11,000 acres of forested land. The closure of the burned area to the public will help reduce the spread of invasive plant species, protect cultural resources and reduce risk to the public from dangerous conditions created by the destruction of roads, trails and other infrastructure.

2. PRELIMINARY EVALUATION OF THE EFFECTIVENESS OF THE EMERGENCY ASSESSMENT OF POSTFIRE DEBRIS-FLOW HAZARDS FOR THE 2009 STATION FIRE (U.S. GEOLOGICAL SURVEY OPEN-FILE REPORT 2009-1227)

S.H. Cannon, J.E. Gartner, M.N. Hanshaw, J.W. Kean, R.N. Leeper, K.M. Schmidt, and D.M. Staley. U.S. Geological Survey.

In response to the 2009 Station fire the U.S. Geological Survey (USGS) performed an emergency assessment of the postfire debris flow hazards. A set of statistical-empirical models were used to estimate the probability and volume of debris-flow production from 678 drainage basins within the burned area and to generate maps of areas that may be inundated by the estimated volume of material. The assessment identified the primary drainages of the burned area as having the potential for significant debris-flow impacts to infrastructure located within and immediately downstream from, the burned area. Conditions in all but the smallest basins along the San Gabriel mountain front between Big Tujunga Canyon and Arroyo Seco indicated a significant potential for debris-flow impacts to neighborhoods and infrastructure along the San Gabriel mountain front.

During the winter of 2009–2010, nine distinct storms affected the burned area, and four of these produced damaging debris flows. The November 12, 2009 and December 11–13, 2009 storms were localized along the San Gabriel mountain front, where several sediment-retention basins were filled to, or near, capacity, homes were damaged and the Angeles Crest Highway was closed. The January 18, 2010 and February 6, 2010 storms generated damaging debris flows and sediment-laden floods from nearly every basin within the burned area, and caused widespread road closures and damage to homes and infrastructure. Impacts were consistent with those identified in the hazard assessment. An equivalent response to similar storm conditions can be expected for the winter of 2010–2011.

3. POST-WILDFIRE SURFACE MATERIAL MAPPING OF THE STATION FIRE USING AIRBORNE VISIBLE-INFRARED IMAGING SPECTROMETER (AVIRIS) DATA

T.M. Hoefen[1], R.F. Kokaly[1], R.O. Green[2], G.A. Swayze[1], and G.S. Plumlee[1]. [1]U.S. Geological Survey, Denver, CO, 80225; [2]Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, 91109.

The Station Fire started on August 26, 2009, just outside Los Angeles, California. By the time the fire was contained it had burned an area of ~650 km^2. On October 6, 2009, NASA's AVIRIS instrument

collected imaging spectrometer data as part of an instrument calibration stability investigation covering the burn area of the Station Fire. The AVIRIS data consist of 224 contiguous ~10nm spectral channels between the wavelengths of 0.36 and 2.50 microns. The spatial sampling for this dataset was ~10 m. AVIRIS data were converted to reflectance using ground-calibration measurements and radiative transfer software. Ash and soil samples were collected from within the burn perimeter, and their spectra were measured in the laboratory. These spectra were added into a spectral library, which included spectra of minerals and vegetation. Using spectral feature comparisons, surface material maps were generated based on the unique spectral characteristics of each material. The resulting maps show the distribution of ash/char and its relative abundance, green and partially burned vegetation cover, and the mineral composition of exposed soil and rock areas. We are integrating this information with digital elevation models, and other spatial data, to define areas vulnerable to erosion and slope-failure. We are also linking the spectral data to the ash and soil chemistry and other datasets to define areas of environmental concern for humans and wildlife. The maps extend plot-based knowledge of the fire's effects on soils to the wider landscape, thereby increasing our understanding of post-fire hydrologic and ecosystem processes.

4. RAINFALL AND PEAK STREAMFLOW FOLLOWING THE STATION FIRE: A BENCHMARK FOR PREDICTIVE MODEL VALIDATION

P. Wohlgemuth. USDA Forest Service, Forest Fire Laboratory, Riverside, CA, 92507. K. Wright. USDA Forest Service, Sequoia National Forest, Porterville, CA, 93257. T. Hogue. UCLA, Department of Civil and Environmental Engineering, Los Angeles, CA, 90095. P. Robichaud. USDA Forest Service, Forestry Sciences Laboratory, Moscow, ID, 83843. B. Roath. USDA Forest Service, Pacific Southwest Region, Vallejo, CA, 94592. B. Hill. USDA Forest Service, Pacific Southwest Region, Vallejo, CA, 94592.

During the Station Fire of late summer and fall 2009 in Los Angeles County, hydrologists of the USDA Forest Service Burned Area Emergency Response (BAER) team used existing models to predict post-fire floods and sediment production for planning and risk assessment. These modeling tools were inadequate for the task. However, the Station Fire presented an opportunity to acquire field data of peak discharge and sediment yield from burned watersheds to serve as a benchmark to validate existing models or improve them. We deployed six recording precipitation gauges to measure local rainfall amounts and intensities in the mountains above an area between La Canada and Sunland. We established stream channel cross sections in six watersheds and re-surveyed them repeatedly to measure high water marks so that peak discharges could be indirectly calculated using the USGS Jarrett equation. Sediment was captured in debris basins maintained by the Los Angeles County Department of Public Works, but these yield data are not yet available. The results of the peak stream flow calculations and their associated rainfall show that peak runoff is best correlated with the maximum 10-minute storm intensities. Comparisons of these field data with published tables of probable post-fire peak discharges show that this model underestimates peak flows from burned watersheds. Together with the anticipated sediment yield data, we plan to test the performance of several other models of hydrologic and erosion response to improve the predictive tools for post-fire watershed risk assessment.

5. VALIDATION OF POST-FIRE HYDROLOGY MODELS ON A SELECTED SITE IN THE SOUTHWESTERN UNITED STATES

L. Chen, M. Berli, and K. Chief. Desert Research Institute, 755 East Flamingo Road, Las Vegas, NV 89119.

Wildfires are of increasing concern in the southwestern United States due to their threat to life either by direct impact on humans and property or, indirectly, by changing hydrologic properties of watersheds. Post-fire peak flow and runoff quantity can be increased by 2–3 orders of magnitude, which significantly intensify flooding, debris flow, and landslides. This study examined the capability of process-based models (HEC-HMS and KINEROS) and empirical rule-of-thumb approach in predicting post-fire rainfall-runoff process. The SCS curve number method combined with unit hydrograph approach were selected in the HEC-HMS model as a representative for lumped modeling approach. The KINEROS model, using an advanced infiltration model and kinematic-wave runoff routing method, was a more physically-based

model. The two models were applied to San Dimas Experimental Forest and calibrated to a pre-fire and post-fire storm event. The modeling results showed that optimized modeling parameters for pre-fire and post-fire conditions were significantly different. Post-fire curve numbers were higher than pre-fire condition, and post-fire hydraulic conductivity was significantly lower than pre-fire values, leading to larger post-fire runoff coefficient. Although calibrated separately, HEC-HMS showed a much lower performance for post-fire event while KINEROS performed just reversely. This result implies some fundamental reasons that runoff generation mechanism in forested watershed may have changed or partially changed from saturation excess runoff or subsurface storm dominated to infiltration excess dominated mechanism. In addition, the empirical approach did not show to be reliable. This suggests that physically-based modeling may better reflect post-fire hydrological responses.

6. ENVIRONMENTAL AND HEALTH-HAZARDS CHARACTERIZATION OF AIRFALL ASH, RESIDUAL ASH, AND SOILS FROM AREAS BURNED BY 2007–2009 SOUTHERN CALIFORNIA WILDFIRES AT THE WILDLAND-URBAN-AGRICULTURAL INTERFACE

G.S. Plumlee, T.M. Hoefen, S.A. Morman, P.L. Hageman, D.A. Martin, R. Kokaly, R.E. Wolf, H.A. Lowers, J.M. Holloway, W.M. Benzel, G.P. Meeker, and C. Stricker. U.S. Geological Survey, Denver, CO 80225.

Since 2007, wildfires have burned over a million acres in southern California. We have characterized residual ash and soil samples from wildland, residential, and agricultural areas burned by seven 2007 fires, the 2008 Tea fire, and the 2009 Jesusita, Station, Morris, and Cottonwood fires. We have also characterized airfall ash samples collected in residential areas downwind from the Station and Jesusita fires. Most samples were collected within several days after combustion. Many analytical methods have been used to characterize features of the ash and soil samples that are of potential environmental or health concern.

Results show that ash and soil characteristics vary considerably depending upon type (wildland, agricultural, residential, airfall), combustion intensity, vegetation type, and underlying bedrock geology. The results can be used to help understand and anticipate potential ecological and environmental-health risks associated with wildfires. For example, the first rain to fall on a burned area may, depending upon burn intensity and storm characteristics, initially produce alkaline runoff potentially detrimental to aquatic organisms; any impacts would likely diminish with increasing dilution over time and downstream. Runoff from burned areas (particularly residential areas) may contain particulate and dissolved metal and organic toxicants available for uptake by aquatic organisms. The abundance of respirable, caustic alkali particles in more heavily combusted ash and high concentrations of metal toxicants in residential ash substantiate public health warnings that appropriate respiratory, eye, and skin protection should be worn by people exposed to heavy ash fallout or working in burned residences or wildland areas after fires.

7. ASSESSING THE PHYSICAL AND GEOCHEMICAL IMPACTS OF WIDLFIRE ON AN URBAN FRINGE WATERSHED

Megan P. Burke and Terri S. Hogue. Water Resources and Hydrology, UCLA, Department of Civil and Environmental Engineering, Los Angeles, CA 90095.

Wildfires remove vegetation and alter soil properties, influencing both the timing and magnitude of stream response to precipitation in burned watersheds. Additionally, burned soils are more easily erodible, and any contaminants bound to these soils, such as metals, are more readily transported to and within surface waters during storms. The 2009 Station Fire burned more than 160,000 acres in Los Angeles National Forest, including 100% of the upper portion of the Arroyo Seco Watershed. This watershed is highly impacted by atmospheric deposition of urban contaminants, as it is located on the leeward side of Los Angeles in the front range of the San Gabriel Mountains. Impacts of the wildfire may exacerbate existing water quality issues in the Arroyo Seco. Stream sampling of storm-runoff in the upper Arroyo Seco Watershed was conducted during both the 2008/09 (pre-fire) and 2009/10 (post-fire) rainy seasons. Samples were measured for nutrients and metals, as well as basic geochemistry, and contaminant loads were estimated for each season. Building upon previous work on post-fire behavior in other regional watersheds, a preliminary analysis of the impacts of the Station Fire on the physical and geochemical response of the upper Arroyo Seco Watershed to precipitation events will be presented.

8. POST-FIRE DEBRIS-FLOW MONITORING IN THE STATION FIRE: INITIAL OBSERVATIONS FROM IN-SITU MEASUREMENTS OF 11 DEBRIS FLOWS

J.W. Kean and D.M. Staley. U.S. Geological Survey, Denver, CO, 80225.

Steep, recently burned watersheds are extremely vulnerable to debris flows as a result of vegetation removal by fire. In southern California the combination of mountainous terrain, dense population, and high fire-frequency put new areas at risk to debris flows each year. In an effort to improve predictions of the timing and magnitude of post-fire debris flows, the U.S. Geological Survey (USGS) conducts detailed hydrologic monitoring in recently burned areas throughout Southern California. In response to the 2009 Station Fire, we established debris-flow monitoring sites in four burned watersheds, which ranged in size from 0.01 to 1 km^2. These sites recorded, for the first time, detailed measurements of the hydrologic conditions leading up to and during post-fire debris flows. Measurements included precipitation, soil water-content, flow stage, pore pressure, and video. Here, we present initial observations and comparisons of the 11 debris flows recorded to date. The debris flows span a wide range of magnitudes: from small, 0.2-m high surges at the smallest study site, to an extremely destructive 4-m high surge recorded at one of the large sites. All of the observed debris flows were generated by progressive bulking of sediment from hillslope rilling and channel erosion, which occurred in response to high intensity bursts of rain. Continued post-fire debris-flow monitoring in Southern California should provide detailed documentation of the varied flow responses that can occur in post-fire settings, and this, in turn, will help develop and constrain modeling approaches for post-fire debris flows.

9. EVALUATING CONTROLS ON HYDROLOGIC RECOVERY IN BURNED WATERSHEDS IN THE SAN BERNARDINO MOUNTAINS

Alicia M. Kinoshita and Terri S. Hogue. Water Resources and Hydrology, UCLA, Department of Civil and Environmental Engineering, Los Angeles, CA 90095.

A post-fire investigation of two watersheds (City Creek and Devil Canyon) burned during the 2003 Old Fire in southern California explores the spatial and temporal dynamics of post-fire vegetation and the subsequent influence on seasonal and annual hydrologic response in chaparral-dominated systems. Post-fire climatology, burn severity, slope aspect, and vegetation (proxied by a Moderate Resolution Imaging Spectroradiometer (MODIS) Enhanced Vegetation Index (EVI) satellite product) dynamics are evaluated. Results indicate a significant increase in discharge up to four years after fire, with elevated dry season flow, which is correlated to post-fire vegetation recovery, level of burn severity, slope aspect, and seasonal precipitation patterns. South and west facing slopes show higher pre-fire EVI (biomass) values and largest declines in vegetation. Overall vegetation biomass is not to pre-fire conditions by the end of the five-year study period, influencing both energy and water dynamics.

10. VEGETATION MAPPING AND CLASSIFICATION OF THE PALOS VERDES NATURE PRESERVE

Lily N. Verdone. Palos Verdes Peninsula Land Conservancy, 916 Silver Spur Road, Rolling Hills Estates, CA 90274; lverdone@pvplc.org.

The Palos Verdes Peninsula Land Conservancy received grant funding through the California Department of Fish and Game's Local Assistance Grant program to produce a fine-scale, spatially and floristically accurate vegetation map of the Palos Verdes Nature Preserve (PVNP). The PVNP is part of the draft Rancho Palos Verdes Natural Community Conservation Plan (RPV-NCCP) area, and encompasses approximately 1200 acres of protected open space. The PVNP is located in the City of Rancho Palos Verdes, in southern Los Angeles County. The project area represents several biologically rare habitat types, including coastal sage and cactus scrub. In addition, the PVNP hosts several rare and endangered plant and animal species, which are classified as covered species in the RPV-NCCP. Vegetation resources were assessed through field surveys, resulting in the classification analysis of 26 vegetation alliances, 38 vegetation associations or semi-natural stands, and mapping of 583 vegetation map polygons. The results of this project are a detailed, accurate map of the vegetation in the PVNP. This

information can now be used to answer questions ranging from species-specific management to targeting the most likely places to reduce fuel loads. We can now find precise location information for specific habitats of covered species, identify areas for conservation within sensitive natural communities and habitats with invasive species, restore habitat value based on various attributes, and create linkages to wildlife habitats through restoration.

11. COASTAL SAGE SCRUB RESTORATION AND REVEGETATION USING A SUCCESSIONAL MODEL

Margot Griswold, Ph.D. NewFields AER, Restoration Group, Los Angeles, CA 90018.

Following observed natural regeneration in coastal sage scrub communities, a successional model for restoring and reclaiming areas of coastal sage scrub has been used over the past 15 years for a number of projects over approximately 600 acres in southern California. The consideration of landscape position and soils is essential when determining coastal sage scrub restoration using a successional (or any other) model. The successional model is used to define the plant species required to inhabit the site through the early weed-prone stages of coastal sage scrub development to establish a resilient habitat. This restoration model relies mainly on seeds to establish the coastal sage scrub habitat. Examples of development of coastal sage scrub in the initial five-year establishment period as well as development in the following 10 years, show that sites following a successional model remain relatively weed free. Such sites are able to recover from natural disturbance such as fire, demonstrated by the ongoing recovery of a 108-acre site burned in the 2007 Santiago fire.

12. IN THE WAKE OF WEED MANAGEMENT: ONE STEP FORWARD, TWO STEPS BACK

J.J. Knapp. Native Range, Incorporated, 4360 East Main Street, Suite A #478, Ventura, California, 93003.

Coastal scrub has been invaded to varying degrees by non-native invasive plants throughout California. Land managers understanding the threats posed by invasive plants regularly undertake management actions to remove these invaders from this unique habitat type; however, little attention or concern of the impacts caused by intervening measures to remove invasive plants are rarely considered, nor are the long-term costs. Impacts associated with ground-based access, including damage to vegetation, soil disturbance, wildlife disturbance, and the dispersal of invasive species, can have long lasting effects on the system which the land managers were attempting to enhance. In doing so, land mangers are taking one step forward in removing the initial invader, but are taking two steps back by leaving a wake of disturbance in their path. The duration of treatment projects can compound the cost and impacts associated with weed control. Helicopter-based access methods have been developed to reduce and in some cases eliminate the risks associated with invasive plant management at the landscape level. Intensive and systematic use of small helicopters to survey and access invasive plant infestations in fragile ecosystems have demonstrated that eradication criteria can be met, which include the ability to, 1) detect all individuals, 2) removal all individuals, and 3) outpace reproduction. The advantages and disadvantages of conducting ground-based and aerial-based control methods will be presented with examples of work conducted on both the Channel Islands and southern California mainland.

13. INVASION AND RESTORATION OF COASTAL SAGE SCRUB: ABOVE AND BELOWGROUND FEEDBACKS

S.J.M. Dickens, E.B. Allen, and L.S. Santiago. Department of Botany and Plant Sciences, University of California Riverside, Riverside CA 92521.

Due to natural and anthropogenic disturbances, coastal sage scrub (CSS) has become an endangered ecosystem covering less than 20% of its original range. Exotic plant invasion has been a driver and stabilizer in the loss of this rare habitat. Restoration efforts to address the rapid type conversion of CSS to exotic grasslands, meet with varied success. The effect exotic plants have had on CSS soil chemistry, soil processes and the potential for restoration of soil processes is unknown. We examined the effect of exotic

plant invasion on soil chemical pools and the function of abiotic and biotic processes that maintain healthy CSS ecosystems. The hypotheses included (**1**) Presence of exotic plant species changes characteristics of soils by altering litter inputs. (**2**) If exotics are controlled and natives restored, soil characteristics will return to pre-invaded conditions because soil inputs of native plants would be restored. While the plant tissue chemistry of the exotic plants was different from natives, the total soil carbon and nitrogen and extractable phosphorus did not differ between invaded, restored and native CSS. Extractable nitrogen pools and nitrogen cycling rates differed between invaded, restored and native soils early in the growing season and between growing seasons; this may be a reflection of below average rainfall during our experiment or a difference in phenology between exotic and native plant species leading to temporally different resource use patterns. Potential respiration rates did not differ between sites. Overall, most soil chemical characteristics were unchanged by invasion and restoration, however, timing of nitrogen availability may be changing and could be facilitating exotic plant growth at the expense of native plant species.

14. COMPARATIVE PHYSIOLOGY BETWEEN COASTAL SAGE AND CHAPARRAL OF THE SANTA MONICA MOUNTAINS

S.D. Davis[1], A.L. Jacobsen[2], and R.B. Pratt[2]. [1]Pepperdine University, Natural Science Division, Malibu CA, 90263; [2]California State University, Department of Biology, Bakersfield, CA, 93311.

Coastal sage scrub typically occupies drier habitats than chaparral in the Santa Monica Mountains of southern California. Surprisingly, at ecotones where coastal sage neighbors chaparral, representative species of each vegetation type (*Salvia mellifera* and *Ceanothus megacarpus*) display nearly identical water status during seasonal drought, approaching midday water potentials (Ψ_{md}) of −9 MPa. However, the physiological response to these extremes in Ψ_{md} and subsequent rehydration differ considerably. *S. mellifera* experiences three-fold higher water-stress induced embolism of it stem xylem in response to Ψ_{md} than *C. megacarpus* (78% versus 17% loss in hydraulic conductivity). After winter rehydration, *S. mellifera* develops a nearly two-fold greater xylem specific conductivity (4.1 versus 2.2 m^2 MPa^{-1} s^{-1}), photosynthetic rate (24.9 versus 16.9 μmol m^{-1} s^{-1}) and transpiration rate (6.7 versus 3.8 mmol m^{-1} s^{-1}) than *C. megacarpus*. Presumably, *S. mellifera* inhabits drier sites than *C. megacarpus* because of drought deciduousness in summer and higher growth rates that facilitates rapid construction of new xylem and leaf tissue during spring growth. Recent data suggest that these patterns may be generalized to the broader coastal sage and chaparral communities of the Santa Monica Mountains.

15. EFFECT OF EXOTIC ANNUAL GRASS REMOVAL ON THE RE-ESTABLISHMENT OF COMMON NATIVE OAK UNDERSTORY SPECIES ON SANTA CATALINA ISLAND, CA

Matthew P. Sutton and Darren R. Sandquist. California State University, Fullerton, Department of Biological Science, Fullerton, CA, 92834-6850.

Studies on the regeneration of Island scrub oak (*Quercus pacifica*) have shown that competition with exotic annual grasses significantly reduces vigor of *Q. pacifica* seedlings. We examined recruitment of oak understory species at five sites with dying *Q. pacifica* and in 2009 we implemented two restoration methods, exotic annual grass removal and seed addition. This experiment tested the following two hypotheses: 1) Exotic annual grass removal increases percent cover and species richness of native oak understory species, and 2) sites receiving both herbicide treatment and seed addition will have an increased vigor of native species. Monitoring data from both 2009 and 2010 support hypothesis 1 with respect to species richness: in 2009 the grass removal plots had a higher species richness ($\mu \pm$ SE: 1.9 ± 0.22) than the control plots ($\mu \pm$ SE: 1.48 ± 0.16). Moreover, the 2010 data support hypothesis 1 with respect to percent cover; whereas, the 2009 data do not. For example, in 2009 the percent cover of native species was greater in the control plots ($\mu \pm$ SE: 11.63 ± 4.46%) than in the grass removal plots ($\mu \pm$ SE: 9.12 ± 4.60%). Similarly, 2010 data support hypothesis 2; whereas, 2009 data refute it. Overall, the results indicate that seed addition and herbicide application increase native cover and richness; however, the early application of herbicide in 2009 may have adversely affected native species' vigor. Therefore, subsequent restoration efforts should consider timing of herbicide application.

16. LANDSCAPE RESTORATION IN A COASTAL SAGE SCRUB COMMUNITY

Tara Stark and Dr. Frank Ewers. California State Polytechnic University, Pomona, Biological Sciences Department, Pomona, CA 91768.

Coastal sage scrub (CSS) community is the major shrubland vegetation type of cismontane Southern California. Native vegetation consists of aromatic, shallow-rooted drought-deciduous shrubs such as *Artemisia californica* (California sagebrush). CSS provides a home to more than 200 plant and animal species that are currently endangered, threatened, or of 'special concern'. The Voorhis Ecological Reserve (VER), containing a degraded coastal sage scrub community, is located on the California State Polytechnic University Pomona campus within the San Jose Hills. Although the VER does contain native plants, it also contains a widespread invasive *Hirschfeldia incana* (false or hoary mustard). Biological invasions are second only to land-use change as a cause of species endangerment in the USA, and as urbanization continues so do both habitat loss and decreases in biodiversity. For my thesis project, I applied three different treatments, mowing, herbicide and a combination of the two, plus an untreated control, to ten blocks and monitored their effects on the invasive and native plants. The goal is to increase the ecological integrity of the VER by not allowing one exotic plant species to dominate the entire reserve. Thus far, results suggest herbicide alone is the most effective treatment at reducing *H. incana* percent cover.

17. DIETARY HABITS OF *CANIS LATRANS* ON THE PALOS VERDES PENINSULA

Alfred Fernandez. Palos Verdes Peninsula Land Conservancy, Rancho Palos Verdes, Ca.

Coyotes (*Canis latrans*) are able to exploit a wide range of habitats, and are often found living in highly urbanized settings. The presence of coyotes on the Palos Verdes Peninsula was first noted in the mid-1990's. The site selected for this study is the Forrestal Nature Preserve. The preserve, totaling 163 acres, is located on the southern slope of the peninsula and field observations suggest that this preserve holds a large amount of coyote activity as well as grey and red fox. Habitat at this preserve ranges from mostly coastal sage scrub to riparian, and is surrounded by residential urbanization. Coyotes are the apex predators on the peninsula, though little was previously known as to the specifics of their dietary habits in this area. A scat analysis was conducted to compare the 2007–2008 and 2009–2010 years sets, and to contrast these findings against a study in the Santa Monica Mountains. Invertebrate and avian remains were found in low frequencies. Domestic cat remains were frequently found within scats of both year sets. Lagomorph and rodent remains were found in significant percentages. Vegetative and anthropogenic material was commonly found though the small quantities associated with their presence indicate it is by-catch rather than a dietary staple. These results contrast with the results of the study conducted in the Santa Monica Mountains for while they show a similar level of importance of small mammals in coyote diets, the low quantity of plant material suggests it is less important as a diet item to Palos Verdes coyotes. The presence of domestic cat is significant for it is a dietary item that is absent altogether from the Santa Monica Mountain study.

18. THE USE OF CATCH SHARES IN SUSTAINABLE FISHERIES

M. Helvey. NOAA National Marine Fisheries Service, Sustainable Fisheries Division, Long Beach, California, 90802.

Three important components for a fishery to be considered sustainable need to be operational. There must be a sustainable standing stock biomass to support a particular level of fishing; sustainable fishing practices for minimizing impacts to habitat and for avoiding/minimizing the capture and subsequent release of non-target species must be in place; and a sustainable fleet in terms of employment and profitability needs to be functioning. Fundamental to any sustainable fishery is managing for a healthy stock. Fisheries management has evolved from open access (fishing open to all), to input controls placed on fishermen activities (e.g., types and amounts of gears; limited fishing areas or seasons; limited access), and to output controls (e.g., setting quotas). However, these management strategies only create incentives for fishermen to develop different gears or devise new methods to catch more fish and do so faster than

other fishermen before any overall limit is reached. To solve the "race for the fish" problem, managers started exploring the use of "catch shares" whereby an individual fisherman or fishing group is granted the privilege to catch a specified portion of the overall quota or total allowable catch. The result of catch share programs is that it takes away incentives for fisherman to fish harder or faster.

19. HOW A SNOUT BECOMES A LAW: CODED WIRE TAGS AND THE ENDANGERED SACRAMENTO RIVER WINTER CHINOOK SALMON

D. Lawson. National Marine Fisheries Service, Southwest Region, Protected Resources Division, Long Beach, CA, 90802.

The ocean fishery for Chinook salmon (*Oncorhynchus tshawytscha*) is one of the most important fisheries that occurs off the coast of California. Management of this fishery is complicated by the fact the some population subunits of this species are listed as threatened or endangered under the Endangered Species Act. The Sacramento River winter Chinook (winter-run) Evolutionary Significant Unit (ESU) is listed as endangered and special consideration is necessary to ensure that the ocean salmon fishery is not jeopardizing this ESU. The source of knowledge about the impacts of the fishery on winter-run, as well as for most all salmon ESUs in the Pacific Northwest, is derived from the recovery of fish which have been tagged with small piece of metal in their snout, know as a coded wire tag (CWT). CWTs contain the information that allows the origin of individual fish to be identified, and permits analyses of distribution patterns and estimates of impact or exploitation rates. This presentation is designed to provide an overview of how CWT data is used in the development of fishery management actions that serve to maximize the harvest of certain salmon ESUs while being protective of other salmon ESUs at the same time.

20. DOLPHIN SAFE LABELING AND THE TUNA TRACKING PROGRAM

C. D'Angelo. NOAA National Marine Fisheries Service, Southwest Region, Sustainable Fisheries Division, Long Beach, CA 90802.

In the 1950s, fishermen discovered that large, mature yellowfin tuna often aggregate beneath schools of certain dolphin stocks in the eastern Pacific Ocean. After that discovery, the predominant fishing method for targeting yellowfin tuna in the eastern Pacific Ocean shifted from hook and line to purse seiners that encircle dolphin schools to capture the tuna concentrated below. Hundreds of thousands of dolphins died in the early years of this fishery. Public concern over high levels of dolphin mortality in this fishery led to domestic legislation and international agreements. Among these is the Dolphin Protection Consumer Information Act (1990), which required the implementation of a dolphin-safe labeling standard and a national tuna tracking program. Commonly found on canned tuna in the United States, the dolphin-safe label is the most recognizable symbol of conservation in the marketplace today. This presentation will focus on how the government implements the dolphin-safe labeling standard through the Tuna Tracking and Verification Program. Through this program, NOAA Fisheries monitors all tuna caught by U.S. flag vessels or canned by U.S. processors, as well as all frozen and processed tuna and tuna products imported into the United States. This monitoring program relies on a system of written reports, onsite inspections and audits, and electronic databases to maintain the necessary checks and balances to ensure that tuna sold in the United States, when carrying a dolphin-safe label, is truly "dolphin-safe" and was caught in full compliance with domestic and internationally agreed upon conservation measures.

21. LARGE WHALE ENTANGLEMENT RISK ASSESSMENT, UNITED STATES WEST COAST

L. Saez, D. Lawson, S. Wilkin, E. Petras, M. DeAngelis, and C. Fahy. National Marine Fisheries Service, Protected Resources Division, Long Beach, CA, 90802.

The National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) has identified large whale entanglement in fishing gear as a priority management issue, particularly for the endangered humpback whale. Although numerous whale entanglements along the United States west coast have been reported to NMFS, little information has been confirmed about the origin of the

entangling gear. To help fill this information gap, NMFS is developing a suite of analytical tools to better understand whale entanglement risk along the west coast. One primary goal is to map fishing effort, with a focus on fishing gears that are known or suspected to entangle whales based upon documented sightings and strandings of entangled animals. These fisheries include both state and federally managed fisheries. The objective will be to understand and illustrate the location and relative density of various fishing effort throughout the calendar year. This information will be overlayed with species-specific whale distribution patterns, modeled from systematically-collected sighting data, to help identify spatial and temporal overlap between whales and fisheries. This overlay will identify potential "hot spots" of where and when large whales are more likely to encounter fishing gear, thus have an increased risk of becoming entangled. To improve knowledge of fishing gear, information is being compiled through research with State and Federal fishery experts and fishery representatives during port visits. The identification of spatial or temporal "hot spots", combined with a better understanding of fishing gear, will improve the ability to minimize or mitigate the risk of large whale entanglements.

22. ECONOMIC IMPACT ANALYSIS FOR INFORMING DESIGNATION OF CRITICAL HABITAT FOR THE ENDANGERED LEATHERBACK SEA TURTLE

C.M. Pinkerton and **K.L. Hodges** (Contractor). National Marine Fisheries Service, Sustainable Fisheries Division, Long Beach, CA, 90802.

The leatherback sea turtle was listed under the federal Endangered Species Act (ESA) as "endangered" throughout its range on June 2, 1970. The ESA requires that "critical habitat", an area that is essential to the conservation of a listed species, be designated for any ESA-listed species. On January 5, 2010, NMFS published a proposed rule to designate critical habitat for the leatherback sea turtle off the coasts of Oregon and California. Before designation, careful consideration must be given to the economic impacts, impacts on national security, and other relevant impacts. To inform decision-makers, this economic analysis estimated the potential economic costs of restricting or modifying specific water and land uses that may adversely impact areas considered for designation and the incremental costs attributable to such designation. For each of the specific areas considered, the economic analysis; (1) identified the economic activities that may impact each area's primary biological or physical constituent elements (e.g. prey resources and safe passage); (2) described the baseline level of protections currently covering or affecting those areas; and (3) identified the existing and expected level of economic activity. Using this information, the potential economic impacts (i.e., costs) of the options considered for leatherback sea turtle critical habitat were estimated. These estimates are summed by area and compared to their corresponding conservation value, which were determined in a separate analysis.

23. NOAA FISHERIES SERVICE RECREATIONAL FISHERIES DATA COLLECTION PROGRAMS

M.F. Golden. NOAA Fisheries Service, Long Beach, CA 90802.

The importance of having accurate and comprehensive programs to gather recreational fishing catch data is very important to optimizing recreational fisheries management. The lack of high quality data can lead overly restrictive regulations designed to protect stocks when their condition is not well understood. Conversely, regulations that are not conservative enough may lead to overfishing and then be followed by very strict regulations and possible fishery closures. Paper reviews various Pacific coast recreational fisheries data collection programs.

Collection of recreational fishing catch data generally requires the cooperation of the anglers and/or the fishing vessel captains. NOAA Fisheries Service has funded and/or co-funded a number of programs to gather needed information, usually in cooperation with states. The Marine Recreational Fishery Statistics Survey (MRFSS), funded by NOAA and modified in 2004 to include state programs such as the California Recreational Fisheries Survey (CRFS) has been the basis for Pacific coast data collection since 1978. The Pacific Recreational Fishery Information Network (RecFIN), managed by the Pacific States Marine Fisheries Commission is the regional data repository for the Pacific coast states data (http://www.recfin.org/).

The NOAA Marine Recreational Information Program (MRIP), is now being implemented to gather more detailed information useable for local management issues. The MRIP includes a National Saltwater

Angler Registry so as to make the data collection process more efficient. Details of the MRIP are provided at https://www.countmyfish.noaa.gov/.

The MRFSS, RecFIN, and MRIP were/are the foundation for Pacific coast data collection and are supplemented by other specialized programs for selected fisheries.

25. IDENTIFICATION OF SEAFOOD SUBSTITUTION IN THE LOS ANGELES MARKETPLACE USING DNA SEQUENCING

L.V. Plough[1], Anderson D.A.[2], and Hedgecock D[1]. [1]Department of Biological Sciences, University of Southern California, Los Angeles CA, 90089; [2]Aquarium of the Pacific, Long Beach, CA, 90802.

As world fisheries continue to decline an influx of new, geographically distant, and sometimes exotic seafood products are entering the international market place to meet the growing global demand for seafood. Many of these products come in frozen and processed forms lacking distinguishable morphological features by the time they reach the consumer and the mislabeling of fish and seafood products, also known as seafood substitution, has become a serious issue in the domestic and international marketplace due to concerns over consumer health, trade in threatened or endangered species, and authenticity of products. The application of DNA-based molecular methods has greatly improved the ability to identify seafood products down to the species level and studies of market substitution in the Northeastern U.S. have found around 25% of samples were either mislabeled or substituted, with many instances of less expensive fish being substituted for higher priced fish. We used DNA sequencing techniques to identify the level of seafood substitution in restaurants and seafood suppliers around the Los Angeles region, analyzing a portion of the CO1 mitochondrial gene for most samples, and the more variable mitochondrial control region for tuna samples. We found ~15% of samples were substituted with a completely different species (often of lesser value) and ~8% of samples were either mislabeled or named incorrectly. This level of substitution is similar to other studies and highlights the need for restaurants and seafood suppliers to consider new methods of testing their products and for the standardization of market names.

26. PLACEMENT AND EARLY COMMUNITY DEVELOPMENT OF A NEW ARTIFICIAL REEF IN SANTA BARBARA COUNTY, CA

P.R. Krause. ARCADIS US, Inc. 4640 Admiralty Way, Marina del Rey, CA 90292.

In December 2005 a new offshore artificial reef was established at "Bird Island" in Santa Barbara County, CA. The reef was created from the abandonment of a 1930's era oil production pier remnant. A medium relief subtidal reef was created from large concrete pilings and covered with quarry rock over the abandoned oil production site. The reef lies approximately 900 feet offshore of the coastline in roughly 35 feet of water. The local shoreline and subtidal habitat is predominantly made up of sandy shores interspersed with natural rocky reefs. The subtidal rocky reefs and the sandy substrates support algal forests dominated by the giant kelp (*Macrocystis pyrifera*). The reef was designed to provide complex habitat that would support the establishment of communities of algae, invertebrates and fishes that would function similarly to the surrounding natural reef areas. The purpose of this ongoing study is to provide quantitative data on the successional changes in the establishment of the reef communities. The general study design is a paired-design time series in which data from benthic quadrats, band transects, and photo-transects are used to compare the Bird Island Reef communities to a nearby natural kelp reef. Data was collected during three periods throughout 2006. Initial data suggest that fish and invertebrate communities have become well established at the reef within the first year.

27. AN ASSESSMENT OF REEF FISH COMMUNITIES ON ARTIFICIAL AND NATURAL REEFS IN THE SOUTHERN CALIFORNIA BIGHT

J.E. Granneman and M. Steele. Department of Biology, Northridge, CA, 91330.

Despite the extensive use of artificial reefs worldwide, it is still not clear how well these manmade structures mimic natural reefs or whether they succeed in increasing the net production of fishes in an area.

To determine how closely artificial reefs mimic natural reefs, we studied five pairs of artificial and natural reefs in the Southern California Bight. Underwater visual transects were used to quantify fish and invertebrate assemblages on the reefs and to measure physical characteristics of the reefs. Artificial reefs had greater fish densities and higher species richness of fishes along the benthos than found on natural reefs, but there was no difference in fish density and species richness in the water column. Overall, artificial reefs were found to have significantly greater fish densities and higher species richness than natural reefs. Artificial reefs were also found to be more rugose and had greater vertical relief than natural reefs; whereas macroalgae was more abundant on natural reefs. The artificial reefs studied were generally smaller than the natural reefs, but largest artificial reefs tended to be most similar to the natural reefs. There was a positive correlation between both reef rugosity and invertebrate density with fish density. No significant correlation was observed between species density and reef size or macroalgae density. Multiple regression analysis revealed that reef rugosity was the best predictor of both species richness and fish density. Overall, the differences in habitat on the two reef types likely explain the patterns of fish density and species richness observed.

28. A NEW METHOD TO ASSESS WATER QUALITY AND URBAN IMPACT IN CALIFORNIA ROCKY REEF SYSTEMS: MEASURING METAL CONCENTRATIONS IN KELP (*M. PYRIFERA*) SIEVE TUBE SAP

L.A. Fink*. California State University, Long Beach, 1250 Bellflower Blvd., Long Beach, CA 90840; Current address: Vantuna Research Group, Occidental College, 1600 Campus Rd., Los Angeles, CA 90041.

Implementing ecosystem-based management will require new, cost-effective techniques to quantify coastal contamination and toxicity. In southern California, Marine Protected Areas (MPA's) will be implemented in urbanized coastal regions where water quality impacts and monitoring are of special concern. Large percentages of the proposed MPA's consist of hard bottom rocky regions, however, no simple methodology currently exists for assessing coastal water quality over these areas. Using a sentinel species such as Giant Kelp (*Macrocystis pyrifera*) as a biomonitor can indicate both spatial distribution of bioavailable contaminants near MPA boundaries, and their potential accumulation into higher trophic levels within this important ecosystem. *Macrocystis pyrifera* sequesters trace metals into its sieve tube sap (STS) from the surrounding environment often magnifying the concentration present in ambient seawater. STS was extracted from *M. pyrifera* fronds collected monthly for one year from 10 southern California locations, and was measured for concentrations of 17 metals. Several metals commonly below limits of detection in seawater were detectable within STS, and some metal concentrations (As, Sr, Hg) represented the highest values ever measured within *Macrocystis* tissue. Significant spatial gradients of decreasing STS metal concentration (Zn, Sr, Mn, Ni, Pb) were found with increasing distance from shore. Certain STS metals appeared to increase in concentration simultaneously, which may allow one to distinguish specific point source signatures of runoff-associated metals. Results suggest this innovative method may be useful as an additional tool in MPA monitoring design, allowing further assessment of ecosystem recovery over time.

29. RESOURCE-LIMITED REGULATION AND COHERENCE IN OC/SD KELP BEDS: A CASE STUDY OF SAN ONOFRE KELP

Eric F. Miller. MBC Applied Environmental Sciences, 3000 Red Hill Ave., Costa Mesa, CA 92626.

The giant kelp (*Macrocystis pyrifera*) kelp beds along the Orange and San Diego County coastlines have been monitored at least annually since 1967. Each year, the annual maximum aerial canopy has been recorded. A high degree of coherence among the 16 most persistent kelp beds in the area was recorded. Prior to the 1977 regime shift, the total maximum aerial canopy was relatively stable while the post-shift surveys recorded much greater inter-annual variability. Utilizing nutrient data recorded during CalCOFI hydrocasts, significant relationships between individual kelp beds and nutrient concentrations has been identified for nearly two-thirds of the 16 persistent kelp beds in the area. This general relationship was expressed in the San Onofre Kelp Bed ($R^2 = 0.44$), one of the most intensely studied kelp beds in the area due to its proximity to the San Onofre Nuclear Generating Station. Earlier studies predicted the operation

of the plant would result in significant impacts to the nearby kelp bed, specifically effects of the increased turbidity caused by the power plant discharge. Subsequent empirical observations have not supported this prediction. No significant differences were detected in stipe density between the San Onofre Kelp Bed and the nearby San Mateo Kelp Bed, nor were any relationships detected between discharge effects and annual surface canopy measurements. Contrary to prior studies, the San Onofre Kelp Bed, like nearly all beds in the area, was regulated by resource availability (bottom-up) rather than consumer-limited (top-down).

30. KELP, I NEED SOMEBODY

T.K. Ford and B.M. Meux. Santa Monica Baykeeper, 120 Broadway, Suite 105, Santa Monica, CA 90401.

Santa Monica Baykeeper began the Kelp Restoration and Monitoring Project in 1997 as a response to the large scale degradation of *Macrocystis* dominated macroalgal assemblages in southern California. Focusing work on Los Angeles County reef systems, the Kelp Project has restored over 4 acres of kelp forest off Malibu, and over 4.5 acres off Palos Verdes to date, with restoration work continuing off the Palos Verdes Peninsula. Measures of success in restoration sites include a reduction of urchin density to approximately one to two urchins per square meter, and an increase in kelp density to 1 kelp plant every 10 square meters, along with a comparison between restoration, reference, and control sites. In 2009, a new restoration site of 1.2 acres near Long Point, Palos Verdes (K-Cove) was monitored and restored, using both metrics of kelp and urchin densities. A large volunteer effort relocating over 118,000 urchins in 6 months enabled rapid recruitment and growth of kelp plants in restoration sites, reaching kelp density levels above those found in nearby reference sites. Long-term monitoring results show restored sites to have equal or greater kelp density levels persisting at or above reference levels for over 6 years.

31. GETTING TO KNOW YOUR SOUTH COAST MPAS: NEARSHORE ROCKY REEF ECOLOGY OF POINT VICENTE SMR

J.P. Williams, D.J. Pondella, II, and Jeremy T. Claisse. Vantuna Research Group, Occidental College, Department of Biology, Los Angeles, CA, 90041.

In preparation for the establishment of a network of marine protected areas in southern California, rocky reef sites throughout the bight were studied using CRANE methodology multiple times over the last six years. The lone proposed protected area along the coast of the Palos Verdes Peninsula is a series of pinnacles and rocky headlands near Point Vicente and Long Point (designated as Point Vicente SMR) and adjacent Abalone Cove (Abalone Cove SMCA). The unique bathymetry, geology and oceanography inside Point Vicente SMR creates an area rich in fish, invertebrate, and algal diversity that incorporates species groups similar to other distant areas throughout the Southern California Bight – including the Channel Islands. Similarities in species composition, density, richness and diversity, habitat substrate and relief, as well as taxa that are typically associated with areas other than Palos Verdes Peninsula provide us with a view of the complexity, uniqueness and importance of the reefs that will be encompassed in Point Vicente State Marine Reserve.

32. LIFE HISTORY INFORMATION CAN IMPROVE UNDERSTANDING OF MPA EFFECTS FOR A VALUABLE FISHERY SPECIES

J.T. Claisse. Vantuna Research Group, Occidental College, Department of Biology, Los Angeles, CA, 90041.

Hundreds of thousands of juvenile yellow tang, *Zebrasoma flavescens*, are caught each year in the state of Hawaii for the live aquarium trade. An extensive adaptive management strategy was developed around a network of protected areas (MPAs) to improve fishery sustainability. Since early 1999, monitoring of the protected area network created a wealth of data on abundance of fish. However, interpretation was limited by a lack of information about yellow tang life history and species biology. Our research filled these gaps by investigating habitat specific patterns of life history, and ontogenetic patterns of habitat use and movement. Yellow tang are a long lived species (the oldest individual collected was 41 years old) and

display an asymptotic growth pattern. They exhibited ontogenetic differences in daily movement patterns. Recruits and juveniles remained strongly site attached, while adults appear to have high site fidelity to individual daytime foraging, nighttime sheltering and sunset spawning locations. These results improved the interpretation of long term monitoring data and led to important refinements in monitoring protocols of the MPA network. Small juvenile home range, the potential for adult spillover, and almost exclusive removal of only juveniles may make MPAs a particularly effective management tool for this fishery.

33. REFINING MPA MONITORING TO MEET MLPA REQUIREMENTS

E.A. Whiteman and C.A. Recchia. MPA Monitoring Enterprise, California Ocean Science Trust, 1330 Broadway, Suite 1135, Oakland, CA 94612.

Under the 1999 Marine Life Protection Act, California is establishing a statewide network of marine protected areas. These MPAs have been designed to meet multiple goals including protecting the natural abundance and diversity of marine life, rebuilding depleted populations and protecting the structure, function and integrity of marine ecosystems. Moreover, adaptive management of the regional MPA networks is mandated; future management decisions are likely to include consideration of changes to the MPAs, such as changing MPA sizes, altering spacing between MPAs and modifying allowed activities within MPAs.

Much MPA monitoring today focuses on assessing differences in densities and sizes of organisms inside and outside MPAs, but this is insufficient to assess progress against broader ecosystem goals. We present a novel framework for MPA monitoring that adopts an ecosystem focus to (1) track trends in ecosystem condition through time using practical and informative indicators and (2) evaluate the effects of specific MPA management and design decisions to inform adaptive management. Monitoring ecosystem-level change in response to MPA implementation offers feasible and efficient insight into many different system components (species, populations, habitats, fishing, socioeconomics, climate, etc.) and also provides a road-map to integrate monitoring results and generate key messages that are useful to managers and the public interested in broad ocean 'health' questions. This approach responds to the ecosystem-based policy framework but is pushing the boundaries of our scientific knowledge. The framework is designed to both promote and adapt to increasing scientific understanding of the factors maintaining healthy, resilient marine ecosystems.

34. THE STATUS OF MAINLAND REEFS IN THE SOUTHERN CALIFORNIA BIGHT

D.J. Pondella, II. Department of Biology and Vantuna Research Group, Moore Laboratory of Zoology, Occidental College, 1600 Campus Rd. Los Angeles, CA 90041.

The mainland reefs of the Southern California Bight were surveyed extensively throughout the 2007–2008 sampling seasons using the CRANE (Cooperative Research and Assessment of Nearshore Ecosystems) protocol. This research was completed by instituting a comprehensive rocky reef monitoring program for the Santa Monica Bay Restoration Commission and the implementation of Southern California Coastal Water Research Program's Bight '08 Rocky Reefs program. In this collaborative program, 29 mainland reefs were surveyed from Cojo to Point Loma. In addition to routine ecological metrics (richness, diversity, biomass and density), a habitat quality model based upon fish guilds, density, size and fidelity was used to evaluate the relative quality of these nearshore reefs. Reef quality varied based upon habitat characteristics, fishing pressure, turbidity and sedimentation.

35. THE EXISTENCE, IMPORTANCE, AND CONTRIBUTION OF FISH SPAWNING AGGREATIONS TO THE ECOSYSTEMS AND FISHERIES OF THE TEMPERATE WATERS OFF SOUTHERN CALIFORNIA

Larry G. Allen[1] and **Brad E. Erisman**[2]. [1]Southern California Marine Institute, Terminal Island, CA; [2]Scripps Institute of Oceanography, La Jolla, CA.

Fish spawning aggregations (FSAs), the large and temporary gatherings of fishes for the sole purpose of reproduction, represent one of the most incredible biological phenomena of the marine realm. Spawning

aggregations are important biological events crucial to the life history of many reef fishes. They are also very important to commercial and sport fisheries worldwide, because they often involve species of high market value and high-quality meat. We know that tropical FSAs are declining and disappearing worldwide due to overfishing and poor management. However, little attention has been paid to the existence, importance, or contribution of FSAs to the ecosystems and fisheries of temperate zones. This is unfortunate, since this same phenomenon occurs in the vicinity of kelp forests, rocky reefs, and sand flats of temperate zones. The fisheries which target aggregating species in these ecosystems face many of the same conservation and management challenges and require many of the same management strategies that have been identified for tropical species. Moreover, such information is very important to the direction in which fisheries management in California is headed (i.e., ecosystem-based management). The purpose of this talk is to: 1) review some important biological and fishery characteristics of four reef associated fishes (white seabass, barred sand bass, kelp bass, and giant sea bass) that form spawning aggregations off southern California, 2) discuss the interaction between fishing, spawning and the effects of overfishing aggregations, and 3) propose options for management of aggregations based on the success of a recent policy.

36. VIABILITY OF BACILLUS PUMILUS SAFR-032 SPORES AFTER EXPOSING TO SPACE AND SIMULATED MARS CONDITIONS USING EXPOSE EUTEF MODULE

Kasthuri Venkateswaran. Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA.

Spores of a radiation resistant strain of Bacillus pumilus SAFR-032 isolated from a spacecraft associated surfaces were flown (Feb, 2008 to Sep, 2009) to the International Space Station (ISS) and exposed to a variety of space conditions using the European Technology Exposure Platform and Experiment Facility (EuTEF). The exposure conditions were: (i) space vacuum, (ii) solar extraterrestrial UV radiation including vacuum-UV, (iii) simulated Martian UV radiation regime, and (iv) galactic cosmic radiation. During ground simulation, the desiccated spores survived full Martian UV (200–400 nm) exposure (87 hours; 30 W m•2) and exhibited only a 2-log reduction in viability. After 18 months exposure in the EuTEF facility under dark space conditions, SAFR-032 spores showed 10 to 40% survivability whereas the survival rate (85 to 100%) increased when these spores were kept aboard the ISS under dark simulated Mars atmospheric conditions. In contrast, when UV (>110nm) was exerted on SAFR-032 spores for the same time period and conditions using the EuTEF, a ~7-log reduction in viability was noticed. However, the UV exposure did not kill all spores as 20 CFUs were later isolated via cultivation. In addition, further research was carried out to characterize any genetic or proteomic changes in these survived spores. The data generated is important to assess the probability and mechanisms of microbial survival, microbial contaminants of risk for forward contamination, in situ life detection, and to safeguard the integrity of sample return missions.

37. UNEXPECTED INCREASES IN MICROBIAL DIVERSITY ALONG A SALINITY GRADIENT IN A SOLAR SALTERN IN BAJA CA, MEXICO

Jesse Dillon[1], Mark Carlin[1], Andriana-Amparo Gallegos[1], Nathan McLain[1], and Shereen Sabet[1,2]. [1]California State University, Department of Biological Sciences, Long Beach, CA 90840; [2]Current address: LaSierra University, Department of Biology, Riverside, CA 92515.

The diversity of organisms that inhabit environments is thought to decrease as they become more extreme. While this has been supported in some studies, this is still an open question. The goal of this study was to use both cultivation and molecular sequencing (16S rRNA and *bop* genes) to compare the diversity of planktonic halophiles at increasing salinity (from 15% to saturated brines at >30%) in an evaporative saltern, the Exportadora de Sal, Baja CA, Mexico. Members of four bacterial and three archaeal lineages were cultured from different sites in the saltern, with greater broad-scale phylogenetic diversity of bacteria observed at lower salinities while cultural archaeal diversity was similar across the gradient. Salinity growth ranges and optimal salinity varied more among halobacterial cultures compared with haloarchaea. As expected, uncultured diversity was much higher for both bacteria and archaea. Archaeal OTU richness was significantly higher at 30% compared to the 15% salt pond, and was dominated by diverse

Haloquadratum-like lineages at higher salinity. This pattern is mirrored in preliminary *bop* gene diversity analyses with greater numbers of highly supported phylogenetic clades from the 30% salinity sample, primarily comprised of uncultured haloarchaeal lineages. Interestingly, bacterial richness was as high or higher than archaea in both 15% and 30% samples. These findings suggest that existing paradigms about the effects of salinity on prokaryotic diversity including the balance between bacterial and archaeal domains need to be adjusted in some settings and further investigation into the ecology of these diverse uncultured halophiles is warranted.

38. SHOULD I STAY OR SHOULD I GO? INSIGHTS INTO THE PHYSIOLOGICAL ECOLOGY OF *VARIOVORAX PARADOXUS*

Paul M. Orwin. California State University San Bernardino, Department of Biology, San Bernardino, CA, 92407.

Our lab has been investigating the Gram negative bacterium *Variovorax paradoxus* EPS, a soil microbe cultivated from the semi-arid coastal sage scrub soil. We have used functional genomic and physiological approaches to examine sessile and motile surface-attached lifestyles in this organism. Our physiological approaches have demonstrated that this microbe forms robust biofilms and uses flagellar activity along with the production of a wetting agent to translocate across a surface by swarming. We have also identified a number of genetic elements that alter both biofilm formation and swarming motility, including exopolysaccharide production, type IV pilus formation, and a number of signaling and regulatory loci. The completion of a draft genome sequence for this organism has allowed for further insight. Recently we have observed that these surface attached behaviors are related to resistance to *Caenorhabditis elegans* predation. We hypothesize that this is a major component of the ecological success of this microorganism, along with its ability to utilize diverse nutrient sources.

39. BACTERIAL BIOFILM INACTIVATION BY GAS DISCHARGE PLASMA: AN OVERVIEW

Graciela Brelles-Mariño. Biological Sciences Department, California State Polytechnic University, Pomona, CA 91768.

Biofilms are microbial communities embedded in an exopolysaccharidic matrix and responsible for undesirable effects including disease and prosthetic device contamination. Cooperative interactions among members of the biofilm make conventional methods of controlling microbial growth often ineffective. Therefore, there is a need to develop novel sterilization techniques and the use of gas discharge plasmas represents an alternative method.

My laboratory first studied biofilms produced by *Chromobacterium violaceum*, a bacterium present in soil and water. Biofilms were subjected to plasma for different exposure times and 99.6% of culturable cells were inactivated after a 5-minute treatment. However, physiological and metabolic determinations, atomic force microscopy (AFM) and fluorescence microscopy showed that non-culturable cells were still alive after short plasma exposure times. These results indicate that viability experiments are indispensable before drawing the conclusion that plasma kills cells based solely on culturability.

We are presently studying plasma-mediated inactivation of *Pseudomonas aeruginosa* biofilms grown on different surfaces such as polycarbonate, stainless steel, and borosilicate. AFM is being used out to study changes in cell morphology and biofilm structure for various plasma exposure times and also to study micromechanical properties of the biofilms. Results indicate nearly 100% of biofilm inactivation after 5-minutes of plasma exposure. (These results will be discussed by Anna Zelaya in her presentation).

Results show the potential of plasma as an alternative method for biofilm removal. We expect that our study will provide the fundamental understanding of plasma-assisted biofilm inactivation and its mechanisms and build the basis for the future development of the technology.

40. BATTLING PSEUDOMONAS BIOFILM WITH GAS DISCHARGE PLASMA

A. Zelaya[1], S. Lwin[1], G. Stough[2], N. Rad[2], K. Vandervoort[2], and G. Brelles-Mariño[2]. California State Polytechnic University, Pomona, [1]Department of Biological Sciences, [2]Department of Physics, Pomona, CA, 91768.

Bacterial biofilms are communities embedded in an exopolysacchiridic matrix. Biofilms of the opportunistic pathogen *Pseudomonas aeruginosa* cause infections in immunocompromised patients and contaminate prosthetic devices and indwelling catheters of hospitalized patients. Common antimicrobial techniques are often ineffective against biofilms. The use of gas-discharge plasma is a potentially useful alternative to traditional sterilization techniques. This study examines the effects of gas discharge plasma on 1, 3, and 7-day-old biofilms of *P. aeruginosa* (PAO1) grown on either polycarbonate, stainless steel, or borosilicate coupons in a CDC biofilm reactor (BioSurface Tech, MT). An atmospheric pressure plasma jet was generated with an Atomflo^{TM} 250 reactor (Sur*fx* Tech. CA) using a mixture of He and N_2 gases. Biofilms were exposed to plasma for various exposure times and processed to determine CFUs/mL after incubation. Results indicate nearly 100% of biofilm inactivation after 5-minutes of plasma exposure. The inactivation kinetics are similar for 1, 3, and 7 day-old biofilms and show a rapid decline in the number of surviving cells followed by a much slower decline. Cell concentration for the control is two log units higher for 3 day-old biofilms compared to 7 day old ones, suggesting that the attachment is time-dependent and decreases after time. No differences were observed for the 3 materials used. AFM images show changes in cell morphology and biofilm structure for various plasma exposure times. Micromechanical properties of biofilms are presently being studied through force versus distance curves. Results indicate the potential of plasma as an alternative method for biofilm removal.

41. BIOFILM FORMATION OF STAPHYLOCOCCUS EPIDERMIDIS AND PSEUDOMONAS AERUGINOSA ON TI-6AL-4V AND TI-6AL-4V-BORON ALLOYS

Jessamine Quijano[1], Scott Marzano[1], Graciela Brelles-Mariño[1], Vilupanur Ravi[2], and Steve Alas[1]. [1]Department of Biological Sciences and [2]Department of Chemical & Materials Engineering, California State Polytechnic University, Pomona, CA 91768.

Human prosthetics are being utilized more frequently as the populations that require their use expand. The development of modern human prosthetics has resulted in more biocompatible implants, but they continue to lack acceptable longevity due to prosthetic loosening that is caused by metal corrosion or chronic infection. One major area of concern is the formation of antibiotic resistant biofilm on the prosthetic surface during infections. Using *Pseudomonas aeruginosa* and *Staphylococcus epidermidis*, two bacteria that commonly create biofilm on patient implants, we investigated the biocompatibility of novel titanium alloys with regard to their susceptibility to biofilm propagation. The biometals examined were stainless steel (SS), commercially pure titanium (CPTi), Ti-6Al-4V (Ti64) and 3 novel titanium alloys that contain 0.05%, 0.4%, or 1.0% boron. Biofilm formation was analyzed using crystal violet staining and fluorescent microscopy. Ideal experimental conditions were obtained using flasks with 50mL TSB media for 24 hours at 37C or using a biofilm reactor with 350mL TSB media, and allowing incubation for 48 hours at 37C. Biofilm reactor experiments were performed with or without a constant infusion of growth media during biofilm formation. Media flow rates were established to prevent bacterial saturation during biofilm formation in the reactor. Results indicate that the Ti64 metal alloy permits less biofilm formation than SS, CPTi and the titanium-boron alloys, by both *Pseudomonas aeruginosa* and *Staphylococcus epidermidis*, using all three methods performed. Thus, the Ti-6Al-4V alloy may be a better alternative to traditional metals, stainless steel and pure titanium, as a modern prosthetic biometal.

42. A BACTERIAL SIGNALING PATHWAY CRITICAL FOR A RHIZOBIA-PLANT SYMBIOSIS

Esther J. Chen[1], Robert F. Fisher[2], Virginia M. Perovich[1], Erich A. Sabio[1], and Sharon R. Long[2]. [1]Department of Biological Science, College of Natural Sciences and Mathematics, California State University Fullerton, Fullerton, CA 92834-6850; [2]Department of Biological Sciences, Stanford University, Stanford, CA 94305-5020.

Fixed nitrogen is often a limiting nutrient for plant growth. Rhizobia (root-associated bacteria) form endosymbioses with legume plants in which the rhizobia fix atmospheric nitrogen and supply fixed nitrogen directly to the plant. In the agriculturally important symbiosis between *Sinorhizobium meliloti* and alfalfa, the bacterial signaling pathway ExoS/ChvI has a critical role in establishing the symbiosis. In addition, orthologs of ExoS/ChvI are required for the virulence of both the mammalian pathogen *Brucella abortus* and the plant pathogen *Agrobacterium tumefaciens*, suggesting that ExoS/ChvI has a conserved

role in microbe-host interactions. In *S. meliloti*, ExoS/ChvI activates the transcription of the *exo* genes for exopolysaccharide biosynthesis. In addition, ExoS/ChvI mutations in *S. meliloti* result in pleiotropic phenotypes, including defects in symbiosis, motility, biofilm formation, and nutrient utilization. We have identified new transcriptional target genes controlled by ExoS/ChvI signaling via microarrays with *chvI* mutant strains. From this set of newly-identified target genes, we found direct transcriptional targets of ChvI using gel shift assays. Furthermore, we identified a 25-bp DNA sequence directly bound by ChvI using DNase I footprint analysis. Our work represents an important foundation for studying a signaling pathway required for establishing the *S. meliloti*-alfalfa symbiosis.

43. ISOLATION AND CHARACTERIZATION OF OIL-RICH ALGAL STRAINS FOR AGRICULTURAL WASTE WATER TREATMENT AND AS A FEEDSTOCK FOR BIOFUEL PRODUCTION

Marcia Murry. mmewers@csupomona.edu, Microbiology, College of Science Hossein Ahmadzadeh, mhahmadzadeh@csupomona.edu', Department of Chemistry, Cal Poly Pomona.

Microalgae are photosynthetic organisms with high productivity that can produce lipids, rather than carbohydrates, as their primary storage molecule. Thus, there is considerable interest in mass cultivation of algae to produce feedstock for renewable fuel production. Key to the economic feasibility is the use of native oil-rich isolates to ensure high oil yields and adaptation to local conditions. Many believe that making cost-efficient algae-based biofuels will also require coupling algaculture with use of specific local resources and mitigation of environmental problems to be economically feasible.

Native oil-rich species were isolated from local ponds and agricultural sites that grow rapidly under adverse conditions of high ammonia and urea concentrations, salinity and alkalinity. Growth kinetics, lipid profiles and content, heterotrophy, health of the photosynthetic apparatus and environmental factors regulating lipid biosynthesis in candidate strains were assessed using both traditional and rapid screening methods. Lipid biosynthesis in many strains was triggered by nitrogen deprivation, a desirable trait for controlling and optimizing oil production in large-scale ponding operations, particularly in wastewater treatment scenarios where N is more limiting to algal growth than phosphate. Several candidate strains are now being grown in pilot scale ponds using artificial wastewater. Monitoring physiological processes will lead to process control in pond operations including species control and optimization of lipid production.

44. HERPES SIMPLEX VIRUS TYPE-1 (HSV-1) USES ZEBRAFISH ENCODED 3-*O*ST-3 RECEPTOR TO MEDIATE ENTRY AND SPREAD

S. Hubbard and **Tiwari V**. Western University of Health Sciences, Department of Basic Medical Sciences, Pomona CA, 91766.

Heparan sulfate proteoglycans (HSPGs) modified by human glucosaminyl 3-*O* sulfotransferase-3 (3-*O*ST-3) isoform generates cellular receptor for herpes simplex virus type-1 (HSV-1). Interestingly, the ability of zebrafish (ZF) encoded 3-*O*ST-3 isoform to modify heparan sulfate (HS) to mediate HSV-1 entry and cell-cell fusion has not been determined although it is predominantly expressed in ZF, a popular model organism to study viral infections. Here, we demonstrate that the expression of ZF encoded 3-*O*ST-3 isoform renders the resistant Chinese hamster ovary (CHO-K1) cells to become susceptible for HSV-1 entry. The following lines of evidence support the important role of ZF encoded 3-*O*ST-3 isoform as the mediator of HSV-1 entry into CHO-K1 cells: (i) ZF 3-*O*ST-3 expressing CHO-K1 cells were able to preferentially bind HSV-1 glycoprotein D (gD), and (ii) CHO-K1 cells expressing ZF encoded 3-*O*ST-3 acquires the ability to fuse with cells expressing HSV-1 glycoproteins. Finally, knocking down of 3-*O*ST-3 receptor by siRNA in zebrafish fibroblasts cells significantly reduced HSV-1 entry. Taken together our results provide novel insight into the significance of ZF 3-*O*ST-3 isoform as an HSV-1 entry and fusion receptor and its potential involvement in the HSV-1 disease model of ZF.

45. GLUTATHIONE AND CONTROL OF *MYCOBACTERIUM TUBERCULOSIS* INFECTION

Dr. Vishwanath Venketaraman. Assistant Professor, Western University of Health Sciences, 309 East Second Street, Pomona, CA 91766. USA.

We found that glutathione (GSH) plays a key role in limiting intracellular growth of *M. bovis* BCG in human peripheral blood monocyte-derived macrophages (HMDM). Thus, GSH has direct antimycobacterial activity, functioning as an effector molecule in innate defense against *M. tb* infection. These results unfold a novel and potentially important innate defense mechanism adopted by human macrophages to control *M. tb* infection. Consistent with these observations, we have also found that GSH mediates growth control of virulent *M. tb* in human blood cultures. These results indicate that GSH induces inhibition of *M. tb* growth by both direct antimycobacterial effects as well as by activating the functions of immune cells. Importantly, our most recent studies indicate that GSH in combination with cytokines such as IL-2 and IL-12, activate of natural killer (NK) cells to control *M. tb* infection. Intracellular levels of GSH are depleted in patients with acquired immunodeficiency syndrome (AIDS) in whom the risk of tuberculosis (TB), particularly disseminated disease, is many times higher than that of healthy individuals. Most importantly, our recent studies demonstrate that GSH levels are significantly reduced in peripheral blood mononuclear cells (PBMC) and red blood cells (RBC) isolated from individuals with active TB. *These results led us to hypothesize that the functions of NK cells and dendritic cells (DCs) are significantly compromised due to decreased levels of intracellular GSH. Furthermore, in vitro treatment with a GSH-enhancing agent, N-acetyl cysteine (NAC) will restore the ability of NK cells and DCs to control the growth of M. tb.* We therefore tested the effects of NAC, either alone or in combination with IL-2+IL-12 on up-regulating NK cell activating receptors (NKG2D, NKP30, NKP44, NKP46), FasL and CD40L, by staining the human NK cells with immunofluoresence antibodies and detection using flow cytometry. We observed that treatment of NK cells with IL-2+IL-12+NAC in most cases resulted in maximum up-regulation of in the expression NKG2D, NKp44, NKp30, CD40L and FasL. Treatment of NK cells with NAC alone resulted in two-fold increase in the expression of NKG2D and NKp44 and a maximum increase in the expression of CD40L. These results signify the importance of GSH (both alone and in combination with IL-2+IL-12) in up-regulating the expressions of activating receptors, CD40L and FasL on NK cell surface. These activating receptors and ligands serve as markers for NK cell activation and regulate the important functions of NK cells including induction of apoptosis of target cells. We also tested the effects of GSH in regulating the expression of DC markers such as HLA-DR, CD80 and CD86 and correlated the increased expression with enhanced control of *M. tb* in human monocyte derived DCs. Treatment of DCs with NAC alone or NAC in combination with LPS resulted in enhanced expression of CD80, CD86 and HLA-DR leading to improved control of *M. tb*. Our results indicate that the apoptosis of H37Rv-infected monocytes and killing of intracellular H37Rv by NK cells is mediated by the interaction of FasL-Fas and/or CD40L-CD40 and furthermore, signifies the role of GSH in mediating these pathways, either directly or in conjunction with IL-2 and IL-12. Correlating the expression of co-stimulatory molecules and IL-12 levels also indicate the importance GSH in regulating the functions of DCs and provides further insights on the consequences of this effect on T cell functions.

46. THE NOVEL IDENTIFICATION OF ACIDOCHROMOGENESIS IN NONTUBERCULOUS MYCOBACTERIA

Beatrice Saviola. Basic Medical Sciences, College of Osteopathic Medicine, Western University of Health Sciences, Pomona, CA, 91767.

For the past 51 years the Runyon System has divided nontuberculous mycobacteria into four groups based on the production of pigment either constitutively (scotochromogens), in response to light (photochromogens), not at all (nonchromogens), and growth rate. Using these parameters, medical microbiologists have differentiated among many mycobacterial species. I have identified a number of mycobacterial species previously thought to be nonchromogens which produce pigment in response to acidic stress, a novel inducer of pigment. I have tested for and demonstrated acidochromogenicity in many rapidly growing mycobacterial species of the Runyon Class IV and Runyon Class II designation previously thought to be non-chromogenic. These nontuberculous mycobacteria are generally environmental bacteria which at times can cause human disease. Acidic stress can be found in the environment in soil, lakes, and streams. In a human host acidity can be encountered within the phagosomes of macrophages, where mycobacteria reside. The discovery that pigment is produced in response to acidic stress indicates that atypical mycobacteria may employ pigment production as a means to avoid environmental damage due to a lowered pH. Genes involved in pigment production may be virulence factors and be necessary for survival *in vivo* in a human host.

47. STUDYING ROCKY REEFS AND FISHES OF THE SOUTHERN CALIFORNIA BIGHT; FOUR DECADES OF RESEARCH

D.J. Pondella, II. Department of Biology and Vantuna Research Group, Moore Laboratory of Zoology, Occidental College, 1600 Campus Rd. Los Angeles, CA 90041.

The Vantuna Research Group at Occidental College has a core time series research program of studying the long-term changes of fish populations at Rocky Point, Palos Verdes and King Harbor, Redondo Beach. These studies, which began in 1974 and continue uninterrupted today, are the longest continual time series of rocky reef fish populations in the world. From 1995–2008, we studied the fish populations of the Southern California Bight in an assessment of the Ocean Resource Enhancement Hatchery Program (OREHP) for the Department of Fish and Game. Both of these programs have been critical in evaluating nearshore management actions. Beginning in 2004 we developed the CRANE (Cooperative Research and Assessment of Nearshore Ecosystems) in collaboration with the Department of Fish and Game, various universities and associated researchers. This necessitated a change our core fish protocols for our spatial scale studies. Since then, we have further expanded this program establishing a cooperative monitoring program for the Santa Monica Bay Restoration Commission and SCCWRPs Bight '08 Rocky Reef program.

48. LONG-TERM MONITORING PROGRAM CHALLENGES – MARINE, THE MULTI-AGENCY ROCKY INTERTIDAL NETWORK

M.E. Helix. U.S. Minerals Management Service, 1111 Jackson St. Ste. 520 Oakland, CA, 94607.

MARINe (www.MARINe.gov) is a partnership of 38 Federal, State and local agencies, Universities and private groups dedicated to the study and management of rocky intertidal shoreline habitats. This long-term monitoring program is the largest program of its kind, with 25 years of continuous data spanning two coastlines. MARINe monitors species at over 100 sites biannually from California to British Columbia and in Maine and Massachusetts. Key assemblages targeted for monitoring include mussels, barnacles, black abalone, seastars, surfgrass, snails, and a dozen algal species. MARINe is funded entirely by the independent contributions of its members, who jointly publish data in peer-reviewed literature and provide information to resource managers and the public.

Now in its 13th year, MARINe has successfully worked through a variety of challenges, supporting the needs of scientists and resource managers by establishing a common purpose and through open discussion at annual meetings. Data collected by MARINe partners over the last two decades were used during listing of the black abalone as an endangered species and now are being used to determine the critical habitat for the species. MARINe data inform a variety of State and Federal resource decisions including potential impacts from Federal offshore oil and gas operations and point source discharges into State waters. MARINe data assist decisions about the designation of Federal and State Marine Protected Areas and supports the NOAA Status and Trends "Mussel Watch" program. MARINe is actively involved in supporting education about tidepools with published curricula and a university textbook.

49. CLIMATE AFFECTS RESPONSE OF AN ISLAND ENDEMIC PLANT TO REMOVAL OF INVASIVE HERBIVORES

A. Kathryn McEachern. USGS-WERC, Channel Islands Field Station, 1901 Spinnaker Dr., Ventura, CA 93001. Diane M. Thomson. Claremont Joint Science Department, The Claremont Colleges 925 N. Mills Ave., Claremont, CA 91711. Katherine A. Chess. Colorado Plateau Cooperative Studies Unit, Northern Arizona University, 1298 S. Knowles Ave., Flagstaff, AZ 86001.

Several invasive eradication programs have been implemented on islands, often with clear benefits for native species affected by introduced predators. However, few detailed monitoring data are available to evaluate the potentially complicated responses to these large-scale community changes or determine whether total eradication of invaders is necessary to reverse declines of native species. On Santa Rosa Island, cattle were removed completely and deer and elk numbers reduced in 1998. We collected and

analyzed demographic data and herbivore damage records from 1995–2006 for over 1000 individuals of *Castilleja mollis*, an endangered plant endemic to the island. Our goal was to characterize the past and ongoing impacts of introduced deer and elk and the response of *C. mollis* to cattle removal. Ungulate-related damage declined steeply between 1997 and 2000 and has remained relatively low since. *Castilleja mollis* abundances rose sharply after 1997 in parallel to these changes, but then began to decline steadily again after 2003. Multivariate regression indicates that both the decline in damage and a decrease in mean growing season temperatures were linked to increasing *C. mollis* populations between 1997 and 2002, while recent declines appear to be caused by higher temperature conditions. Mean growing season temperatures in the region have risen significantly over the last 50 years, suggesting *C. mollis* populations may be increasingly threatened by warming. Climate impacts may in effect counteract and obscure the positive effects of herbivore removal as well as reduce the resilience of *C. mollis* even to lowered rates of herbivore damage

50. SH%T HAPPENS: HOW DESIGNING REDUNDANCY INTO A MONITORING PROGRAM CAN HELP EXORCISE INTRUDING DEMONS AND INCREASE THE OPTIONS FOR ANALYSIS AND ABILITY TO DETECT CHANGE

J.R. Steinbeck. Tenera Environmental Inc., 141 Suburban Rd. Suite A2, San Luis Obispo, CA 93401.

It is difficult to anticipate the range and magnitude of natural catastrophes that might impact sampling locations established as part of a long-term monitoring program. The subject of my presentation is the rocky intertidal monitoring program at the Diablo Canyon Power Plant on the coast near San Luis Obispo in central California. The study began in 1976 and is among the longest continuous monitoring programs on the west coast. I will cover some of the changes to the program that have occurred over the past 30+ years of sampling as a result of natural disturbances and regulatory requirements. Despite all of the changes, both intended and unintended, the study has maintained a level of integrity that allows us to detect impacts due to the thermal discharge from the plant with very high levels of statistical power. This is largely due to the original study design that included multiple impact and control sites. In addition to providing redundancy, I will show how the design has provided us with the flexibility to use different sets of stations in hypothesis testing that were more appropriate for the species being analyzed. Finally, I will show how these principles were applied to a more recent study of human impacts on the rocky intertidal.

51. DEVELOPMENT OF A SOUTHERN CALIFORNIA REGIONAL EELGRASS MONITORING PROGRAM

W.B. Chesney. NOAA's National Marine Fisheries Service (NMFS), Habitat Conservation Division, Long Beach, CA, 90802.

Eelgrass (*Zostera marina L.* and *Z. pacifica*) has long been recognized as an extremely valuable habitat in the marine and estuarine environment. Within Southern California, regulatory programs addressing direct impacts associated with filling, dredging, and placement of structures have been effective at protecting eelgrass resources. However, the effects of water quality impairments, changes in circulation patterns, climate change, and/or other stressors are not well understood or addressed in a comprehensive manner. As a result of expanding concern over of the role of watershed effects, regional environmental stressors, and global climate change and the current, regulatory shift towards ecosystem-based management, it is believed that historic methods of monitoring discrete action areas and local reference sites are inadequate for assessing conservation progress at an ecosystem scale. Therefore, NMFS has initiated the development of a regional eelgrass monitoring program to include a new set of monitoring tools and standards that can be integrated on a regional scale. A stakeholder group has been organized to assist in the development of this program. Management questions have been articulated and available eelgrass information has been compiled into a regional dataset. In addition, a draft framework has been developed that incorporates core monitoring, regional monitoring, and special studies. The program primarily focuses on improving the coordination of existing core monitoring programs and filling gaps between them in order to improve regional monitoring capacity. Special projects are currently being identified, but no specific provisions have been made for implementing them.

52. BALLONA WETLANDS BASELINE ASSESSMENT PROGRAM: APPLICATIONS FOR RESTORATION

K.K. Johnston and S.P. Bergquist. Santa Monica Bay Restoration Commission, Los Angeles, CA, 90045.

The Ballona Wetlands system is the last remaining major coastal wetland in the Santa Monica Bay and Los Angeles County; it is one of approximately 40 coastal wetlands along the 1,045 miles of the Southern California coast between Point Conception and Mexico. The Santa Monica Bay Restoration Commission (SMBRC) is providing the California State Coastal Conservancy (SCC) with environmental monitoring services to collect physiochemical, biological and human use data at the Ballona Wetlands Ecological Reserve (Ballona) in Los Angeles, California. The preliminary baseline assessment will encompass a 2-year period and incorporates a considerable variety of monitoring and assessment strategies.

The project objective is to increase knowledge of the health and functioning of Ballona Wetlands to inform an adaptive management and long-term restoration plan, while developing reproducible, scientifically valid regional wetland monitoring protocols. The Baseline Assessment Program for the Ballona Wetlands involves several tasks, including protocol development with scientific review, coordination with regional restoration programs, implementation of baseline assessment, refinement of protocols for long-term monitoring, and data analysis and reporting. The monitoring protocols have been developed in partnership with the Southern California Wetlands Recovery Project (WRP) as a pilot project for site-specific monitoring (Level-III) within the Integrated Wetlands Regional Assessment Monitoring Program (IWRAP) framework.

53. DISCUSSION OF THE VARIABILITY IN THE POLYCHAETE *NEANTHES ACUMINATA* SPECIES COMPLEX: A PROGRESS REPORT

Donald J. Reish[1], Joerg D. Hardege[2], David Lunt[2], Maggy Harley[2], and Ellen J. Storey[2]. [1]Department of Biological Sciences, California State University, Long Beach; [2]Department of Biological Sciences, Hull University, Hull, United Kingdom.

The *Neanthes acuminata* is a cosmopolitan species which is known by four different names. This report examines the variability which occurs in the population from the eastern coast of United States (*Neanthes acuminata*) and the Pacific coast of United States, Hawaii and Mexico (*Neanthes arenaceodentata*). These populations have been characterized by morphology, chromosome number, DNA, eye color, digestive tract color, egg color, and behavior. Populations from southern California and Connecticut have been in continuous laboratory culture from two to over 200 generations. Preserved specimens are morphologically identical. The chromosome number varies from 18 in California, 22 in Connecticut and 28 in Hawaii. The California worms differ markedly in DNA from those in Connecticut. Specimens from Connecticut have a bright yellow digestive tract and pale yellow ova in contrast to the pale digestive tract and bright yellow-orange ova in southern California populations. Worms from Connecticut and Venice have black eyes in contrast to red eyes in the other populations. All populations studied were found to preferably mate with members from their own locality. California and Connecticut worms failed to mate. At this time it is concluded that we have at least two distinct species in North America. A population from Europe has been established in Long Beach and similar studies are being conducted.

54. PREVALENCE OF CYANOBACTERIAL TOXINS ALONG A NUTRIENT DISTURBANCE GRADIENT IN SOUTHERN CALIFORNIA LAKES

T.M. Magrann, S.G. Dunbar, PhD, M. Sutula, PhD, and D. Boskovic, PhD. Marine Research Group, Loma Linda University, Department of Earth and Biological Sciences, Loma Linda, CA, 92350.

Public lakes in Southern California often have high nutrient concentrations from the use of reclaimed water and from water fowl excrement. This produces favorable conditions for the cyanobacterium, *Microcystis*, which is known for secreting hepatotoxins (microcystin), a carcinogen that causes liver cancer in animals and humans. Sixty-six lakes, ponds, bays, and lagoons along Pacific Coast Highway, from

Santa Barbara to San Diego Counties were evaluated. Cyanobacterial numbers and their toxin levels varied over a nutrient disturbance gradient. Sites with unacceptable toxin levels were found to correlate with particular water chemistry parameters. Alkalinity (OR = 3.4) and particulate phosphate (OR = 2.7) were the most significant predictors of excess toxin production. Total dissolved phosphate (r^2 = 0.101), PO_4 (r^2 = 0.0867), and total phosphate (r^2 = 0.0776) had the largest negative impact on phytoplankton phyla and genera diversity, as measured by the Shannon Index. When PO_4 levels reached 0.6 mg/L, Cyanophyta numbers began to increase, while other phyla decreased. Since removal of dissolved phosphate may improve algal diversity and inhibit the growth of toxin-producing cyanobacteria, this study also used new technology to remove phosphate from the most toxic site, Mason Lake (Irvine, CA). The Blue Pro unit is a modified koi pond ionized sand filtration system which precipitates phosphate using ferric chloride, producing a non-toxic, iron-phosphate cake that can be disposed of in landfill. The pilot study resulted in a 96% reduction in PO_4 and a 94% decrease in algal cells after just one pass through the system.

55. FOOD HABITS AND PREY SELECTIVITY OF THE CALIFORNIA GRUNION (*LEURESTHES TENUIS*) IN THE WATER COLUMN NEAR A SPAWNING BEACH IN ORANGE COUNTY

B.A. Higgins and M.H. Horn. California State University, Fullerton, Department of Biological Science, Fullerton, CA, 92834.

The California grunion (*Leuresthes tenuis*) appears to have evolved a novel jaw protrusion to feed selectively on an abundant prey near the spawning beaches to power its unique and energy-demanding reproductive strategy. The purpose of the overall study is to investigate the divergence of California grunion from Gulf grunion (*L. sardina*), jacksmelt (*Atherinopsis californiensis*), topsmelt (*Atherinops affinis*), and the false grunions (*Colpichthys regis, C. hubbsi*) in jaw mechanics, dietary breadth, and feeding behavior. Here, we report on the diet of two of the fish species and their degree of apparent prey selectivity. Zooplankton were sampled with a 0.5 m, 505 mesh plankton net and adult California grunion and topsmelt simultaneously by neuston net in shallow waters (<5 m) off Bolsa Chica State Beach at night in June 2008. The composition and relative abundance of the zooplankton taxa in the plankton samples and gut contents of the two fish species were assessed by the point-contact method. Results indicated that California grunion were more selective feeders than topsmelt, preying more heavily on mysid crustaceans (77.3% of total hits) compared to 22.5% of total hits for topsmelt. These differences in gut contents of the two silverside species caught at the same time and location suggest that the California grunion is more selective in its diet, as we hypothesized. Mysids are recognized as bountiful, nearshore crustaceans that are active in the water column at night and thus meet the criteria for an abundant and available prey for California grunion near its spawning sites.

56. DOES DELAYED HATCHING IN THE CALIFORNIA GRUNION, *LEURESTHES TENUIS*, AFFECT LARVAL SURVIVAL?

Helena Aryafar and Kathryn Dickson. California State University Fullerton, Department of Biological Science, 800 N. State College Blvd. Fullerton CA 92834-6850.

The California grunion can both spawn terrestrially and extend embryonic incubation in the sand beyond the initial incubation period of 9–14 days post-fertilization (dpf). Maternally supplied yolk provides energy for embryonic and larval development, but it is not known how energy reserves change or whether further development occurs during extended incubation. We tested the hypotheses that delayed hatching in the California grunion results in larvae that have less yolk and reduced post-hatching survival when not fed, but that are longer and have increased swimming activity. We measured notochord length (NL), swimming activity, and yolk surface area of larvae hatched after initial incubation (10 dpf) and extended incubation (28 dpf) at 20°C from 9 batches of fertilized eggs, each from one female and one male. Additionally, we compared the time to 50% mortality in 10-dpf and 28-dpf larvae when starved versus fed. NL was significantly greater in 28-dpf larvae than in 10-dpf larvae from four batches, significantly lower in two, and did not differ significantly in the other three. Volitional swimming activity did not differ significantly between 28-dpf larvae and 10-dpf larvae. Yolk content was significantly lower in 28-dpf larvae from all batches studied. Survival time was reduced in 28-dpf larvae compared with 10-dpf larvae,

corresponding with the decrease in yolk content. The effect of delayed hatching varied among batches for both NL and yolk size, suggesting parental effects. Reduced energy reserves that result in increased mortality when starved, and no compensatory increase in swimming activity suggest that larvae that must delay hatching are at a disadvantage when competing with those that do not.

57. HETEROCHRONY IN DEVELOPMENT DURING EXTENDED INCUBATION IN CALIFORNIA GRUNION

C.L. Moravek and K.L. Martin. Pepperdine University, Department of Biology, Malibu, CA 90263-4321.

Embryos of California Grunion *Leuresthes tenuis*, a beach-spawning fish, are hatching competent within two weeks post fertilization, but do not hatch until triggered by environmental cues. Oviposition occurs out of water at the highest semilunar tides, and embryos develop terrestrially, buried under damp sand. When waves of the subsequent semilunar tide release the embryos, they hatch and begin larval development. Embryonic development to hatching competence is similar to other Atheriniform fishes; hatchlings are at an advanced stage prepared for free swimming and feeding. Subsequent larval development resembles that of other Atheriniformes. If waves fail to reach the buried embryos, they may continue to incubate for up to 35 days post fertilization. During this time the embryos are metabolically active and behaviorally alert. They may be triggered to hatch by agitation in seawater at any time, and they hatch within seconds. Whenever hatching occurs, larval life begins. However, when hatching is delayed for *L. tenuis* beyond the time of hatching competence, development dramatically slows. The embryo does not develop in the same way as a hatchling of the same chronological age. The delayed embryo appears to arrest most aspects of development at the stage of hatching competence, including organogenesis and fin development. Careful examination reveals heterochrony with continued development and growth only in the melanophores, the saggital otoliths, and the marginal teeth during extended incubation. National Marine Fisheries Service, California Coastal Commission, National Geographic Society, and the Grunion Greeters provided support for this project.

58. INFLUENCE OF WATER TEMPERATURE ON SITE FIDELITY AND HABITAT USE OF GRAY SMOOTH-HOUND SHARKS IN A NEWLY RESTORED ESTUARINE HABITAT

M. Espinoza, T. Farrugia, and C. Lowe. California State University, Long Beach, Department of Biological Sciences, Long Beach, CA, 90040.

It is thought that some elasmobranchs use shallow temperate embayments as thermal refuges during summer months, since they may provide a physiological advantage. Documenting abundances and long-term behavioral patterns in response to thermal gradients could increase our understanding on how the gray smooth-hound shark (GSH), a common benthic predator, may use a newly restored habitat in southern California. Abundance surveys and acoustic telemetry were employed to examine the influence of water temperature on site fidelity and habitat use of GSH in the new Full Tidal Basin (FTB) of Bolsa Chica. GSH were more abundant during summer months (May-September), and moved out of the basin during the winter (December-February) when this shallow embayment becomes colder faster than coastal waters. Sharks fitted with acoustic transmitters (n=22) were continuously detected inside the FTB for 5–153 d (March–December). Forays into coastal waters were uncommon until they left for the season. Long-term, fine-scale acoustic data revealed that GSH only used a small core area from the middle FTB (< 5% FTB area); however, they exhibited consistent diel movements in the basin. From 6–12:00 h, sharks moved towards warmer inner habitats, and from 17–20:00 h they moved to cooler outer habitats. GSH also selected soft mud-bottoms with eelgrass more intensively at night, presumably for feeding. Behavioral data and monthly abundances suggest that this newly estuarine habitat may provide a thermal advantage for GSH.

59. FINE SCALE MOVEMENT PATTERNS OF THE CALIFORNIA HALIBUT, *PARALICHTHYS CALIFORNICUS*, IN A NEWLY RESTORED SOUTHERN CALIFORNIA ESTUARY

C.L. Espasandin, E. Fox, C. Whitcraft, B. Allen, and C.G. Lowe. California State University, Long Beach, Department of Biological Sciences, Long Beach, CA 90840.

The California halibut, *Paralichthys californicus*, is an economically important teleost that utilizes wetlands throughout its life history but is under intense harvest pressure. Recent studies indicate juvenile halibut may be found in high densities within coastal wetland habitats, but it is unclear how halibut may use estuaries at different life stages or levels of restoration. This study uses acoustic telemetry to identify patterns of habitat use and movement of the California halibut within the restored marshes in the Huntington Beach Wetlands (HBW). Active tracking of five individuals (mean TL 43.8 ±13.5 cm) revealed a mean daily habitat space of 2355 ± 2204 m^2, less than 2% of the total available habitat and 5864 ± 6906 m^2, less than 7.5%, for the duration of the observation. All individuals showed a high degree of short-term site specificity, often returning to a particular point after swimming bursts (feeding events) or disturbance. Fish have been tracked over three seasons: summer, fall, and winter (2009), with no significant effect on the size of an individual's activity space ($p > 0.05$). All fish remained within a wide (35.6m) tidal channel connecting the two marsh habitats which is characterized by high water flow during tidal change and dense beds of eelgrass interspersed with mud/sandy seafloor. No tagged halibut were observed leaving the estuary over the 10 d tracking period. The consistent use of the HBW by California halibut indicates that restoration effort is functionally successful in providing suitable habitat and food for at least 10 days.

60. ABUNDANCE, HABITAT USE AND MOVEMENT PATTERNS OF THE SHOVELNOSE GUITARFISH (*RHINOBATOS PRODUCTUS*) IN A SOUTHERN CALIFORNIA ESTUARY

T.J. Farrugia, M. Espinoza, and C.G. Lowe. California State University Long Beach, Department of Biological Sciences, Long Beach, CA 90840.

Coastal elasmobranchs such as the shovelnose guitarfish (*Rhinobatos productus*) seasonally use bays and estuaries for mating, pupping and feeding. Monthly abundance surveys were conducted inside the restored Full Tidal Basin (FTB) of the Bolsa Chica Ecological Reserve, California between June 2008 and September 2009. A total of 269 shovelnose guitarfish were captured using beach seines and longlines and each individual was sexed, measured, weighed and externally tagged. Shovelnose guitarfish were present all year, with a decrease during the winter months. Over 96% of the individuals caught were immature juveniles and were most abundant in waters between 20° and 24°C. Concurrently, a subsample of 23 shovelnose guitarfish were fitted with coded acoustic transmitters and continuously tracked within the FTB for 16 months. Telemetry data showed individuals remain on average 73.9 d inside the FTB (range: 15–172 d) and establish 95% KUD home ranges of 178,494 ± 27,824 m^2, representing 12% of the FTB area. Tagged shovelnose guitarfish made few movements between the FTB and the ocean, and displayed activity patterns consistent with night foraging inside the FTB. They also disproportionately selected for mud habitats and water temperatures of 22°C, both of which are more common in the FTB than the neighboring coastal ocean. This study suggests that the restored FTB is important habitat for the feeding and growth of juvenile shovelnose guitarfish, a promising result after 3 years post-restoration.

61. EFFECTS OF A PARTIAL DIET OF PIPEFISH, A LOW-QUALITY PREY, ON THE GROWTH OF CAPTIVE ELEGANT TERN CHICKS

T.J. Flisik and M.H. Horn. Department of Biological Science, California State University, Fullerton, 800 N. State College Blvd., Fullerton, CA, 92831-3599.

The recent increase of pipefish in the diets of seabirds nesting in southern California and eastern Scotland has raised concern about the effects of this low-quality prey on growth rate and fledging success of these energy-demanding birds. The effects of pipefish in the diet of the Elegant Tern (*Thalasseus elegans*) was investigated by raising chicks in the laboratory on a diet of 10% bay pipefish (*Syngnathus leptorhynchus*) and 90% northern anchovy (*Engraulis mordax*), a diet based on the prey composition and provisioning rate of this tern. We predicted chicks fed 10% pipefish would weigh less at fledging (35 days posthatch) than chicks fed 100% northern anchovy. Chicks were raised from day 9 to day 35 post-hatch on one of three diet treatments (n=8): (1) 100% northern anchovy for the entire trial period, (2) 10% pipefish and 90% anchovy for 16 days, then 100% anchovy for the remaining 10 days of the trial period, and (3) 10% pipefish and 90% northern anchovy for the entire trial period. Specific body growth and wing growth did not differ among the three treatments. These findings indicate that Elegant Tern chicks may be able to

buffer the apparent negative effects of low-quality prey if high-quality prey species remain prominent within the diet. Ongoing analysis of chick body composition, and gut passage time further support the tern's flexibility towards a fluctuating prey base. These results, along with prey composition data, are being used to estimate fish biomass and energy delivered to the chicks at the colony.

62. TEMPORAL AND SPATIAL PATTERNS IN ABUNDANCE AND DIVERSITY OF FISH ASSEMBLAGES IN A NEWLY RESTORED SOUTHERN CALIFORNIA COASTAL WETLAND

E.J. Fox, C.L. Espasandin, C. Whitcraft, C.G. Lowe, and B.J. Allen. California State University, Long Beach, Department of Biological Sciences, Long Beach, CA, 90840.

Loss of coastal wetlands and their associated services during the past century has been extensive. To offset such habitat loss, restoration and mitigation are increasingly used as potential solutions. Post-restoration monitoring and assessments for these projects typically focus on structural attributes of the restored habitats, but recent research has emphasized the importance of evaluations that include ecosystem function. In this study, the fish assemblages of two previously restored salt marshes (restored in 1989 and 2009) within a Southern California wetland are described in order to assess restoration success and to compare restoration trajectories differing by 20 years of development. Fish community data is assessed in relation to temperature and benthic invertebrate food sources. A total of 7,429 fishes including over 24 species were collected over a 9-month period between July 2009 and March 2010. Greater than 75% of the total catch comprised three species, *Atherinops affinis*, *Atherinopsis californiensis*, and *Fundulus parvipinnis*. The fish communities sampled were generally similar in species composition and seasonal variability; however the three dominant species differed in their distribution throughout the wetland complex. The mobile, planktivorous species were found in greater abundances in the most recently restored, larger marsh, perhaps indicating that foraging support is a secondary function compared to temperature and predator refuge for these species. In contrast, higher abundances of the estuarine-dependent species in the more mature marsh may indicate that benthic food sources of the intertidal marsh surface are important in determining the distribution of this less mobile species.

63. SEASONAL AND TIDAL VARIATION OF FECAL INDICATOR BACTERIA IN THE BALLONA WETLANDS, LOS ANGELES COUNTY, CALIFORNIA

Lizzy Bairstow and Karina Johnston. The Center for Santa Monica Bay Studies, Loyola Marymount University, Department of Natural Science, Los Angeles, CA 90045.

Two 24-hour fecal indicator bacteria (FIB) surveys were conducted during September 2009 and March 2010 at three locations within the Ballona Wetlands of Los Angeles, California. Surface water samples were collected and IDEXX Entero and Coliform tests were performed on each replicate to determine the densities of FIB (total coliforms, *E.Coli* and enterococci). Collections were conducted every two hours to observe tidal, time and condition correlations with bacteria densities in addition to any seasonal variations. Concentrations ranged from less that 10 MPN/100 mL to over 24192 MPN/100 mL. Such a wide range displays how extreme water conditions can be in wetland habitats as well as indicate the possible threats to wildlife and organism survival in these ecosystems. In addition, FIB at high levels is associated with respiratory and gastrointestinal pathology in swimmers who have come in contact with such water (Haile et al., 1999). Understanding the fluctuation of bacterial levels due to tidal and seasonal changes is a key element in determining how to best use wetlands to lower bacteria levels in urban runoff. In addition, the bacteria sample results provide one component of an in-depth assessment of the current status of the Ballona Wetlands and will assist in restoration planning and assessing the success of future actions.

64. THE EFFECTS OF DELAYED HATCHING ON SKELETAL AND MUSCLE DEVELOPMENT IN LARVAE OF THE CALIFORNIA GRUNION, *LEURESTHES TENUIS*

H. Bansuan, **J. Masumi**, **A. Miranda**, T. Treybig, and K.A. Dickson. California State University Fullerton, Department of Biological Science, Fullerton, CA, 92834.

California grunion, *Leuresthes tenuis*, spawn terrestrially during spring high tides. Fertilized eggs incubate in the sand for 9–14 days until wave action stimulates hatching, but may extend incubation to 30 days post-fertilization (dpf) at 20°C. During extended incubation, energy reserves, embryo viability, and hatching success decrease, suggesting a trade-off between extended incubation and larval survival. We hypothesized that extended incubation results in additional embryonic development; therefore, larvae hatched at 28 dpf will have more muscle and skeletal development than 10-dpf larvae. We also hypothesized that developmental differences will persist in fed larvae at 10 days post-hatching. Gametes were obtained from adults collected at Cabrillo Beach. Embryos were incubated at 20°C and hatched at 10 dpf and 28 dpf. Some larvae from each group were fixed at hatching and others were fixed after 10 days of feeding on brine shrimp nauplii. Larvae were cleared and stained to quantify numbers of dentary and pharyngeal teeth and cartilaginous precursors of the caudal skeleton. Areas of slow-oxidative and fast-glycolytic myotomal muscle were measured in post-anal larval cross-sections. At hatching, 28-dpf larvae had significantly more teeth and caudal skeletal structures than 10-dpf larvae, but cross-sectional areas of slow and fast muscle did not differ significantly. After feeding for 10 days, skeletal differences between 10-dpf and 28-dpf larvae were even greater, and preliminary results suggest that 28-dpf larvae had more fast-muscle fibers and larger slow-muscle fibers than 10-dpf larvae. Additional skeletal and muscle development that occur during extended incubation may improve post-hatching larval survival. (partially funded by NSF grant DBI UMEB 0602922)

65. TECTONIC IMPLICATIONS OF BASALTIC VOLCANISM IN THE OWENS VALLEY, CALIFORNIA

Jessica J. Bruns and David R. Jessey. Geological Sciences Dept., California Polytechnic University – Pomona, Pomona, CA 91768.

Cenozoic basaltic volcanism occurs at four locations in the Owens Valley: Big Pine, Darwin, Coso and Ricardo. Big Pine basalts range in composition from *ne* normative alkali basalt to *Q* normative tholeiitic basalt. Basalts of intermediate composition are rare. Olivine and its alteration product, iddingsite, are uncommon. Darwin basalts span a similar range in composition, but are characterized by a larger population of intermediate olivine tholeiites. Olivine is a common modal mineral, as is iddingsite. The Coso field is characterized by bimodal basalt-rhyolite volcanism. Basalts are primitive *ne/ol* normative alkali basalts with prominent phenocrysts of olivine. The Ricardo field is also bimodal, but the basalts are *Q* normative tholeiites. Iddingsite and calcium siderite pseudomorph and replace olivine.

Owens Valley magmatism spans the transition from Miocene-Pliocene "Basin and Range" extension to Pliocene-Recent dextral shear. Tectonic setting has a significant influence on basalt composition. Basalts that are the products of extension (Ricardo) are tholeiites while those emplaced in regions of transtension related to dextral shear (Coso) are dominantly alkali basalts. The Big Pine volcanics underwent a compositional change from older tholeiites to younger alkali basalts. This can be related to changes in the regional stress pattern from Basin and Range extension to the current regime of right-oblique slip. Darwin basalts do not fit the established pattern.

Isotopic and trace element data suggest Coso magmas reached the surface quickly utilizing conduits created by transtension and did not interact with continental crust. In contrast, Ricardo volcanics were emplaced during a period of pure extension resulting in tholeiitic basalts. The more evolved and silica-saturated basalts (Ricardo) represent assimilation of crustal rocks during periods of ponding at shallow levels within the crust.

66. SCIENCE IN SUPPORT OF COMMUNITY RESILIENCY: THE U.S. GEOLOGICAL SURVEY MULTI HAZARDS DEMONSTRATION PROJECT RESPONSE TO THE 2009 STATION FIRE

S.H. Cannon, R.N. Fisher, M.N. Hanshaw, T.M. Hoefen, L.M. Jones, J.W. Kean, S.C. Perry, G.S. Plumblee, K.M. Schmidt, and D.M. Staley. U.S. Geological Survey.

The Station fire, the largest fire in the history of Los Angeles County, burned over 150,000 acres of the Angeles National Forest. This fire created both a demand and an opportunity for hazards science to be used by communities directly affected by the fire, as well as those downstream of possible postfire impacts.

The Multi-hazards Demonstration Project worked with the southern California community to provide critical information to support postfire hazards response decisions, including 1) evaluation of potential debris-flow hazards to support warning and hazard-mitigation planning of federal, state and local emergency-response and land-management agencies, 2) analyses of rainfall and hydrologic-response data to support planning for evacuations and the deployment of critical resources, 3) monitoring of rainfall, physical conditions in the burned area, and the hydrologic response to provide critical information for warnings and to further our understanding of postfire runoff and erosion processes, 4) analyses of ash chemistry to identify potential impacts on water supplies, and 5) evaluation of potential ecosystem impacts and response, and re-location of threatened endangered species. The Multi-hazards Demonstration Project also participated in a multi-agency public information campaign about the risks posed by debris flows.

67. GRAIN SIZE ANALYSIS AND MECHANICS OF THE 2008 MOUNT WHITNEY FISH HATCHERY MUDFLOW ON THE EASTERN SLOPE OF THE SIERRA NEVADA, INDEPENDENCE, CALIFORNIA

Ivan P. Colburn. Department of Geological Sciences, California State University Los Angeles, Los Angeles, California 90032.

On July 5th 2007 a wild fire flared in the hills west of the Mount Whitney Fish Hatchery grounds. Intense rainfall in 2008 mobilized the regolith on those hills into mudflows that raced down Oak Creek. The north fork mudflow coursed down to Highway 395 leaving an unbroken layer of mud 4 miles long with an elevation drop of more than 2,000 feet.

On site written and photographic records were made of the flow and six representative samples were taken spaced the length of the mudflow for sediment lab grain size analysis at CSULA.

Results of the sample size analyses follow: mud (clay and silt size) ranged from 5–22% with an avg. of 15%; sand size ranged from 53–74% with an avg. of 64.2%; gravel size ranged from 8–35% with an avg. 20.7%.

Each sample studied exhibited clear grain size grading from gravel to mud size. Small air pockets measuring 1–2 mm in diameter were noted to make up 10% of the flow by volume.

A thin film (1–2mm) of clay formed as a top layer giving the flow a lustrous sheen. Prominent shrinkage cracks developed all over the surface of the mudflow as it hardened further indicating high clay content. On top of the flow footprints are preserved illustrating hardening over time.

Laboratory density measurements were made on the mudflow samples in the lab and compared to the density of a variety of rocks. The mudflow specimens proved to be significantly less dense than ordinary sedimentary rock.

68. *EQUUS* MATERIAL FROM THE LA HABRA FORMATION, RALPH B. CLARK REGIONAL PARK, BUENA PARK, ORANGE COUNTY, CALIFORNIA

M.K. Crowe and L. Babilonia. Ralph B. Clark Regional Park, Interpretive Center, 8800 Rosecrans Ave. Buena Park, CA, 90621.

Excavation at the former 1997 "Tony the Pony" excavation site during the 2008–2009 Field season at Ralph B. Clark Regional Park, Buena Park, California yielded twelve associated fossil *Equus* teeth and other bone fragments of long bones, and individual carpal, and tarsal bones. The specimens are from the La Habra Formation, which ranges from late Irvingtonian to early Rancholabrean in age. Water-screening of matrix from the site yielded microfossils that included fresh water snails, slugs, bony fish, *Clemmys sp.* (pond turtle), *Microtus* (vole), *Thomomys sp.* (pocket gopher), and possibly other rodents; this deposition may indicate that these sediments were deposited in a lacustrine environment. The material was measured, documented, categorized and analyzed. The results of this find were compared with those of previous excavations and research. The material found during the excavation season from September 2008 to March 2009 remained consistent with the previous documented results. The prior excavation, in 1997, yielded a partial upper maxilla and several foot bones of *Equus tau*. This original material was compared to the *Equus* material found in the current season. The morphological and physical differences between the two strongly indicate that the "Tony the Pony" excavation site contains at least two different horse specimens.

69. TEMPORAL AND SPATIAL TRENDS MICROCLIMATE FOR THREE SPECIES OF COASTAL SAGE SCRUB ON THE PALOS VERDES PENINSULA

Dalkey A.[1], T. Burns[2], and D. Huh[3]. [1]Palos Verdes Peninsula Land Conservancy, Rolling Hills Estates, CA, 90274; [2]Long Beach Polytechnic High School, Long Beach, CA, 90813; [3]Palos Verdes Peninsula High School, Rolling Hills Estates, CA 90274.

This is an update of a multi-year microclimate study on a 1 m–1 km scale at the Palos Verdes Peninsula, which was started in November 2008. We intend to use the resulting information for coastal sage scrub restoration projects as well as investigate the vegetation response to atmospheric humidity. Small data loggers were deployed at various locations to monitor temperature, relative humidity, and dew point for three coastal sage species: *Encelia californica*, *Opuntia littoralis*, and *Salvia leucophylla*. We affirmed the first year's results. Within the same habitat *Opuntia littoralis* plants are found in areas with relatively higher temperatures and lower humidity, while *Salvia leucophylla* occur in areas with relatively lower temperatures and higher humidity. This year we focused on the seasonal variability along with the spatial differences within the species sites.

70. IS A NEWLY DISCOVERED CHITON BROODER ON SANTA CATALINA ISLAND AN UNDESCRIBED SPECIES?

L.D. Froman and D.J. Eernisse. Cal State Fullerton, Department of Biology, Fullerton, CA, 92834-6850.

In the 1980s, one of us (DJE) documented the taxonomy, reproduction, and population genetics of chitons currently assigned to the genus *Cyanoplax*, including three species that brood their embryos with crawl-away larva. One of these, *Cyanoplax caverna* (Eernisse, 1986) from the vicinity of Monterey Bay, was found to be one of the rare marine species that is both hermaphroditic and self-fertilizing. Recently, more southern brooder populations resembling *C. caverna* were discovered near Pismo Beach and on Santa Catalina Island. The Catalina populations, common under intertidal rockweeds, are more variable in color than *C. caverna*. In this study, mitochondrial 16S ribosomal RNA (16S) sequences of *C. caverna* and the more southern brooders resembling *C. caverna* were determined and compared. Results group all sampled Catalina populations together with high bootstrap support relative to more northern populations. These results are consistent with the Catalina brooders belonging to a separate, still undescribed, southern species. Pismo Beach brooders group only weakly (without strong bootstrap support) with the Monterey Bay *C. caverna*, and not with the Catalina brooders. Pismo Beach and Catalina populations are known to brood but we are still investigating whether one or both of these populations have separate sexes or are hermaphroditic and self-fertilizing as is known for the Monterey Bay *C. caverna*. The color variation and considerable 16S haplotype variation observed for the Catalina brooders might suggest that these are cross-fertilizing, not self-fertilizing, which would have interesting implications for inferring the evolution of self-fertilization from a more southern cross-fertilizing and brooding ancestor.

71. BIOLOGICAL ACTIVITY: THE IMPORTANCE OF FUNCTIONAL GROUPS ON (E)-4,4′-DISUBSTITUTED STILBENES TOWARDS CELL PROTECTION

G.X. Garcia, **S.W. Larsen**, C. Pye, R. Isovitsch, and E.A. Fradinger. Whittier College, Departments of Biology and Chemistry, Whittier, CA, 90608.

Disubstituted (E)-stilbene derivatives are of potential therapeutic value due to their structural similarity to reservatrol. This work probes the relationship between functional group and biological activity. The biological activity of (E)-4,4′-dicyanostilbene, (E)-4,4′-diacetylstilbene, 4,4-(ethan-1-ol)-α4,α4′-dimethyl-4,4′-stilbenedimethanol, and the non-substituted trans-stilbene was assessed using the MTS cell viability assay in differentiated PC-12 cells. These stilbenes were found to be non-toxic to cells at micromolar concentrations. The activity of these stilbenes in the presence of 0.01% H_2O_2, a byproduct of mitochondrial activity, was investigated. It was found that stilbene-H_2O_2 mixtures, where the stilbene functional groups was electron withdrawing, were 2–3 times more toxic than the H_2O_2 control indicating that they may intensify cellular sensitivity to H_2O_2. Fluorescence data supported that stilbenes with

electron withdrawing functional groups may be prone to attack by H_2O_2, potentially resulting in the formation of a cytotoxic compound. In contrast, stilbene-H_2O_2 mixtures, where the stilbene functional group was electron donating, rescued neurons from H_2O_2-induced toxicity. These data indicate that the presence of an electron donating functional group is essential to the protective effect of stilbene derivatives.

72. EFFECTS OF GLUTATHIONE ON DENDRITIC CELL RESPONSE TO *MYCOBACTERIUM TUBERCULOSIS* INFECTION

Brenda Gonzalez[1,2], Karanjodh Johal[1], Carlos Guerra[1], Alan Cundari[1], John Chan[2], and Vishwanath Venketaraman[1,2*]. [1]California State Polytechnic University, Pomona, CA; [2]College of Osteopathic Medicine of the Pacific, Western University of Health Sciences, CA 92336; Corresponding author information: Dr. Vishwanath Venketaraman, Ph. D. Department of Basic Medical Sciences, School of Osteopathic Medicine of the Pacific, Western University of Health Sciences, 309 E Second Street, Pomona, CA 91766-1854. Phone: 909-706-3736. Email: vvenketaraman@westernu.edu.

Glutathione is a tripeptide that regulates intracellular redox and other important aspects of cell physiology. Glutathione plays a major role in immune system enhancement. Dendritic cells (DCs) are potent antigen presenting cells that have the unique ability to migrate from the site of infection to a draining lymph node and subsequently recruit T-cells to the site of infection thereby effectively activating the acquired immune response. In this study, the effects of glutathione on antigen presentation, expression of co-stimulatory molecules and cytokines by DCs and the ability for DCs to induce T helper cell differentiation were investigated in response to *Mycobacterium tuberculosis* (H37Rv laboratory strain) infection. Human DCs were derived from adherent monocytes cultured in the presence of IL-4 and GM-CSF. DCs were treated with either L-Buthionine-S, R-sulfoximine (BSO), an inhibitor of GSH synthesis, or N-acetylcysteine (NAC), a glutathione precursor. NAC and BSO treated DCs were infected with *Mycobacterium tuberculosis*, H37Rv, and intracellular control of growth of H37Rv was studied. Additionally, NAC and BSO treated infected DCs were co-incubated with T-cells and T-cell proliferation along with cytokine production was analyzed using flow cytometry and ELISA assays, respectively. Our results indicate that NAC-treated DCs induced a higher level of T-cell proliferation and importantly NAC treated DCs induced enhanced production of IFN-gamma. In conclusion, glutathione plays an important role in controlling intracellular H37Rv growth by direct antimycobacterial mechanisms. Glutathione also enhances the antigen presentation capabilities of DCs as noted by increased mature CD marker expression, T cell proliferation and IFN-gammaproduction.

73. COMPONENTS OF INNATE IMMUNITY AND ADAPTIVE IMMUNITY IN COOPERATION WITH INCREASED GLUTATHIONE LEVELS AGAINST *MYCOBACTERIUM TUBERCULOSIS* INFECTED MONOCYTES

Vishwanath Venketaraman[1,2*], Karanjodh Johal[1], Brenda Gonzalez[1], and **Carlos Guerra**[1]. [1]Western University Of Health Sciences, College Of Osteopathic Medicine Of The Pacific, Department Of Basic Medical Sciences, Pomona, CA, 91766.

Previous studies under Dr. Venketaraman have shown Natural Killer (NK) cells contributing to cell-mediated growth control of intracellular *Mycobacterium tuberculosis* when adequate levels of glutathione are present. Glutathione (GSH), a tripeptide that protects cells against oxidizing agents and reactive oxygen intermediates becomes compromised in NK cells when in the presence of *M. tuberculosis*. Yet GSH levels are replenished by the addition of N-acetyl cysteine (NAC), a precursor to GSH. In current studies, examination of NK cells in cooperation with IL-2+IL-12, different concentration of NAC and inhibition of cell surface markers such as CD56, Fas Ligand have given new experimental directions to follow up on previous studies done. Furthermore, T lymphocytes are also incorporated in this study with regulation of NAC levels against infected *M. tuberculosis* monocytes. These cell components from the innate and adaptive immunity are critical in controlling *M. tuberculosis* infected monocytes and current studies have given results for this acceptable claim.

74. ASSESSMENT OF FLORAL AND INSECT BIODIVERSITY OF BALLONA WETLANDS

N.M. Hall and B.T. Bergstrom. Santa Monica Bay Restoration Commission, Loyola Marymount University, Department of Natural Science, Los Angeles, CA, 90045.

Plant and insect species identification is an important prerequisite step in assessing specific areas of land for future conservation or development. This ongoing project is being conducted weekly in the Ballona Wetlands in Los Angeles, California beginning in January 2010. Several habitats are being compared including: seasonal wetland, upland grassland, upland scrub, dune, and all marsh habitats. Insects are captured and identified to the lowest possible taxon. Similarly, plant species are collected, pressed, and identified. These data will help determine invasive species throughout the areas. They will also be useful in comparison with previous Ballona studies in order to examine how the assemblage has changed over time. Specific insect and plant correlation is recorded for each sample to see what, if any association exists.

Insect and plant classification is necessary to provide detail and identification of native and non-native species that thrive in the site. The resulting data will generate a database of species within specific habitats and each class will be compiled into two vouchers. Plant and insect species lists will help determine biodiversity between habitats as well as provide information on insect indicator species. This information is crucial to determine the effectiveness of future restoration actions in the wetlands.

75. PREY DELIVERED BY THE CALIFORNIA LEAST TERN TO ITS NESTING COLONY AT THE SEAL BEACH NATIONAL WILDLIFE REFUGE, 1996–2009

Michael Horn[1], Charles Collins[2], and **Jeanette Hendricks**[1]. [1]Department of Biological Science, California State University Fullerton, 800 North State College Blvd, Fullerton, CA 92834; [2]Department of Biological Sciences, California State University, Long Beach, 1250 Bellflower Blvd, Long Beach, CA 90840.

Dropped fish samples were collected from a nesting colony of California Least Terns (*Sternula antillarum browni*) over eight breeding seasons spanning 1996–2009 at the Seal Beach National Wildlife Refuge in southern California. These samples were collected opportunistically during visits to the colony. More than 400 fish were collected during the eight seasons, and a total of 18 different species identified from the dropped fish samples. The samples were represented by mainly bay-estuarine species—topsmelt (58.3%) and California killifish (10.0%), and secondarily by coastal pelagic fishes—Pacific sardine (10.8%) and northern anchovy (4.8%). Greater than 75% of these dropped fish ranged in size from 51 to 80 mm standard length. Overall, our results match well with those from other locations and regions in terms of prey type, size, and habitat. Whether in the Gulf of California or the Pacific coast, California Least Terns feed on small (50–100 mm) bay-estuarine and coastal pelagic fishes with the main foraging habitats and prey species influenced by the distance of the nesting colony to the ocean.

76. RODENT COMMUNITY STRUCTURE AND MICROHABITAT ASSOCIATIONS AT THE BERNARD FIELD STATION, CLAREMONT, CALIFORNIA

L.A. Herington, L. Bledsoe, L. Davis, A. Degrassi, J. Edwards, P. Gonzalez, C. Hauser, B. Kronenfeld, J. Lee, C. Mirzaian, T. Oberg, E. Ortiz, E. Peralta, T. Sterner, T. Treybig, and P. Stapp. Department of Biological Science, California State University, Fullerton, CA 92831.

The Bernard Field Station (BFS) is a 38-ha tract of natural Mediterranean scrub isolated by residential and commercial development in northeastern Los Angeles County. We established live-trapping grids in grassland (GR), Riversidian alluvial fan scrub (RS), and coastal sage scrub (SW) habitats to determine community composition of rodents, estimate population densities and determine if rodent species were associated with particular microhabitats. Each grid was 0.49 ha and had 49 Sherman live traps that were set for three consecutive nights in March 2010. Rodents were ear-tagged and released to estimate population density using the Schnabel method. Microhabitat characteristics were measured at stations where animals were caught. Four rodent species were caught at the RS grid and three species were captured at the SW grid; no rodents were captured at the grassland site. *Peromyscus maniculatus* was common at both the RS and SW sites, with estimated population densities of 26.2 ha^{-1} and 22.1 ha^{-1},

respectively. *Neotoma lepida* was captured only at the RS site, where it was relatively abundant (26.7 ha^{-1}). Single *Neotoma macrotis* were captured at both grids, at traps near large trees. *Dipodomys agilis* was twice as abundant at the SW site (15.5 ha^{-1}) as at the RS site (7.8 ha^{-1}). There were no obvious differences among species in microhabitat characteristics at capture locations, but RS seems to be important habitat for *N. lepida*, while the SW site, with a mixture of shrubs and grasses, appears to be important for *D. agilis*.

77. BIODIVERSITY UNDER A MAGNIFYING GLASS: LATE-SUCCESSIONAL BIOLOGICAL SOIL CRUSTS IN SOUTHERN CALIFORNIA SHRUBLANDS

Rebecca R. Hernandez[1], Kerry Knudsen[2], and Paul Wilson[3]. [1]Department of Botany and Plant Science, University of California, Riverside; [2]University of California, Riverside Herbarium; [3]Department of Biology, California State University, Northridge.

Late-successional biological soil crusts are characterized by the presence of terricolous lichens and bryophytes and develop from mid- and early-successional crusts comprised of soil particles, cyanobacteria, bacteria, green algae, and microfungi. In semiarid southern California, these fragile ecological structures confer several ecosystem services, however, their biodiversity has yet to be described. This study seeks to determine species richness and evenness of macroscopic components of late-successional biological soil crust along a climatic gradient and describe late-successional biological soil crust types in coastal sage scrub and chaparral plant communities. Six sites (400 m^2) were chosen along a climatic gradient and four relevé plots (25 m^2) were established at each site where late-successional biological soil crust development was greatest. Within each relevé, all terricolous lichens and bryophytes were identified and percent cover was estimated for each specimen to determine evenness. Thirty-two species of terricolous lichens were observed in total and species richness increased with decreasing maritime influence. Over half (59.4%) of the lichen species observed were found at a single microhabitat or climate and therefore may be classified as specialists. Results for bryophytes are expected to show similar results. Four distinct late-successional biological soil crust community types are proposed for further study including *Cladonia*-dominated, Riversidian thin soil, *Selaginella bigelovii* terrace, and Casparian biological soil crust. As few macroscopic biological soil crust species were found in more than two sites, conservation areas should include microhabitats within southern California shrublands where these unique community types are most likely to develop.

78. CRYPTIC SPECIES AND SYNONYMS: A RECLASSIFICATION OF THE TROPICAL SPURILLA GENUS

Bonnie R. Lei. Walnut High School, 400 North Pierre Road, Walnut, CA 91789. Department of Biological Sciences, California State Polytechnic University, Pomona, 3801 West Temple Avenue, Pomona, CA 91768-4032.

Tropical Atlantic and Pacific populations of *Spurilla neapolitana* (delle Chiaje, 1841), a widely recognized aeolid due to its breadth of vivid coloration and distribution, and *S. sargassicola* (Kroyer, 1861) are assessed with the purpose of determining the possibility of synonymy between these two species as well as the presence of potential cryptic species.

Complete specimens are compared using morphological and genetic characteristics. Hypervariable 16S rRNA and highly conserved H3 histone gene revealed *S. sargassicola* to be genetically similar to Atlantic *S. neapolitana* and the Bahamas population of *S. neapolitana* to have the most divergence from other *Spurilla* sequences. Morphological evaluation of diagnostically reliable features including the external morphology, radulae, jaws, and reproductive system through SEM micrographs, camera lucida, and digital photography further corroborated the genetic findings.

With the presented data, it is clear that *Spurilla sargassicola* is a synonym of *S. neapolitana*, and thus should not retain a separate name. Furthermore, the population of *S. neapolitana* located in the Bahamas is identified as a likely cryptic species, which will be verified with sequences of an outgroup when specimens are obtained.

79. NUTRIENT ANALYSIS OF THE BALLONA SALTWATER MARSH, ESTAUARY AND CREEK

Dominic Leone and John Dorsey. Santa Monica Bay Restoration Commission, Loyola Maryount University, Department of Natural Science, Los Angeles, CA, 90045.

Nutrient analysis of the Ballona Wetland System was conducted to establish a base record of current nutrient levels. The four nutrients measured were ammonia, nitrate, nitrite and orthophosphate. A 24 hour sampling period was organized to observe any fluctuating levels throughout a non-storm weather day. Three sampling sites were established – two sites in the saltwater marsh and one site in the estuary. Following the 24 hour sampling period, daily sampling was conducted up-steam from the estuary in the creek at three specific runoff points. The purpose of this sampling was to discover points of nutrient entry into the wetland system. Data will be needed to determine progress of pollution control along the Ballona Creek.

80. REVIEW OF ETIOLOGY, HISTOPATHOLOGY, IMMUNOHISTOCHEMISTRY AND DIAGNOSTIC TOOLS FOR SJOGRENS SYNDROME

Sarita S. Mantravadi. CSU Dominguez Hills.

Sjögren's syndrome is considered to be an autoimmune disorder. It typically affects exocrine glands, particularly the lacrimal and salivary glands. Hence patients frequently complain of xeropthalmia and xerostomia and hence the use of the term 'sicca' syndrome. This paper throws light on the relationship of Sjögren's syndrome with benign lymphoepithelial lesion, and Mikulicz's disease. It also discusses the various types of Sjögren's syndrome and its occurrence along with other autoimmune diseases such as rheumatoid arthritis (RA), systemic lupus erythematosus (SLE), and the associated high risk of occurrence of malignant lymphoma. It is thus evident that early diagnosis is key for better prognosis of the patient. The reliability of surgical biopsy of labial salivary glands is compared with parotid gland non-invasive diagnostic imaging with techniques such as ultrasonography and scintigraphy as an aid in identifying patients suspected with this disease process. A salient microscopic feature in these patients is the presence of lymphocytic infiltrates mainly plasma cells in the salivary gland tissue. By the use of histochemistry these focal aggregates of plasma cells have been found to produce large amounts of immunoglobulin (Ig)G- and IgM- antibodies. This is in contrast to plasma cells found in healthy individuals, which secrete mainly IgA- antibodies.

81. METHODS FOR SAMPLING LARGE AND MEDIUM MAMMALS IN BALLONA WETLANDS

McKenna, Lauren, Karina Johnston, and John Dorsey. Loyola Marymount University, Natural Science Department, Los Angeles, CA 90045.

Wetlands are important ecosystems that support a high diversity of wildlife. Varying scientific monitoring strategies are used for different groups of organisms. A data gap appears when we consider incorporating higher levels of the food web, or large mammals. A feasible and efficient method of sampling larger mammals in southern California wetlands, such as the coyote (*Canis latrans*), striped skunk (*Mephitis mephitis*) and cottontails (*Sylvilagus audubonii*), is still uncommon in large-scale monitoring strategies.

We are currently utilizing the camera trap method within the Ballona Wetlands of Los Angeles, California. Camera traps, as well as indirect evidence like feces, burrow holes and paw prints, have given visual confirmation that cottontails and coyotes, as well as some bird species and people, do live in the Ballona Wetlands. This data reveals not only that these species inhabit the wetlands, but also shows where they spend most of their time, enabling us to find distribution ranges. A large percentage of these species live in two main upland wetland habitats. This information will be useful in determining the best case scenario for restoring the wetlands in a way that is beneficial to all wetland life.

82. EXAMINING MULTIPLE AGO GENE CONSTRUCTS IN THE PRESENCE OF P0 TO OBSERVE THE ABILITY OF P0 TO TARGET AGO FOR DEGRADATION

Chad Morris. CSU Fullerton.

Because plants are susceptible to a wide range of viruses that cause infection and disease, it is necessary to find what the virus is targeting in the plants and exactly how the virus is targeting this molecule. Plants have a cytoplasmic defense mechanism termed RNA interference (RNAi), and carry this pathway out through a complex called the RNA-induced silencing complex (RISC). This combination of proteins is made of two components, the Argonaute and a siRNA sequence, which attack foreign RNA molecules for degradation. The Argonaute protein is essential for the cutting target RNAs. In recent studies, it has been shown that viruses co-evolved with their host have devised ways to avoid the targeting activity of RISC. One such protein found in the Poleroviruses is named P0. The viral protein P0 has been shown to suppress RNAi by carrying an F box motif that can target the Argonaute protein of RISC for elimination by commandeering the host machinery for protein degradation. In this research, we will aim to observe the different targeting activity that P0 assumes in the presence of different *Nicotiana benthamiana* Argonaute proteins expressed from gene constructs within the same plant to compare whether different Argonaute proteins are degraded similarly or differently in the presence of the viral protein P0.

83. THE ESTROGENIC EFFECTS OF DIETHYLSTILBESTROL ON THE MATURATION AND DIFFERENTIATION OF EMBRYONIC THYMOCYTES

Faraj Mourad. University of La Verne, Biology Department, La Verne, CA, 91750.

An endocrine disruptor is a chemical that can alter the normal functions of the endocrine system. The endocrine and immune systems are closely related. Hence, endocrine disruptors can potentially impact an organism's well being by impairing the organism's immune system. Indeed, endocrine disruptors have been shown to increase infection and autoimmune disease frequency in an organism by weakening the immune system. One such endocrine disruptor is diethylstilbestrol (DES). While many studies have showed that DES impacts developing thymocytes, no studies to date have examined the minimum threshold for these effects or how effects change as concentration increases. Using an in-vitro array, our research attempted to determine the minimum concentration at which a DES impact can be observed in C57Bl/6 mice. We also attempted to determine the mechanism by which DES effects thymocyte differentiation. Our preliminary data shows a dose dependent decrease in thymocyte viability and alternations in thymocyte population distributions. Over the range of doses tested (3.125, 6.25, 12.5, 25, and 50 μM), increasing DES concentration led to significant decreases in CD4+ intermediate and double positive T-cells populations and increases in double negative T-cell populations. Our work suggests that DES impacts thymocytes by inducing cell death and inhibiting developmental progression.

84. THE EFFECTS OF OCEANOGRAPHIC VARIABILITY AND FISHING PRESSURE ON FISH POPULATIONS AT ROCKY POINT

Chelsea Munoz, Mackenzie Hansler, and Drew Hanson. Vantuna Research Group, Occidental College, Department of Biology, Los Angeles, CA, 90041.

The Vantuna Research Group at Occidental College has been performing diver transects of fish at Rocky Point, Palos Verdes since 1974, as well as invertebrate and algal surveys since 2007. This extensive database allows us to see the effects of large scale, long-term oceanographic phenomena, changes in fishing regulations, and assess the health of one of the largest kelp forest communities in Santa Monica Bay. An examination of the abundance and age of commercially and recreationally important, keystone, and ecological indicator species over the last 35 years shows significant changes in the community structure in relation to specific oceanographic events – like the 1976–1977 regime shift and multiple El Niño/Southern Oscillation events – and fishing mortality related events such as the 1994 ban on nearshore gill nets. These observations can show us what to expect as the next regime shift looms and areas like Rocky Point remain unprotected from recreational and commercial fishing pressure.

85. EVALUATING WILDLIFE CORRIDOR LINKAGES: DO FREEWAY UNDERPASSES CONNECT THE PENINSULAR AND TRANSVERSE MOUNTAIN RANGES?

M.L. Murphy, M.F. Allen, and C.W. Barrows. Center for Conservation Biology, University of California, Riverside, CA 92521-0334, USA.

Free from anthropogenic disturbance, natural landscapes consist of a mosaic of interconnected habitats. A consequence of human development is often the loss of this original connectivity. With the expansion of urbanization, agriculture and alternative energy resource development, desert environments are becoming fragmented at an increasing rate, making knowledge of the impacts on wildlife in these areas especially important. Highway underpasses may function as wildlife corridors, providing both a potential constraint as well as means for wildlife to make safe crossings between suitable habitats in areas where man-made barriers, such as railways and high-speed highways, may be impeding wildlife movement. However, there are few studies demonstrating the degree to which such corridor structures are actually used by wildlife in desert environments. Six pre-existing freeway underpass structures, located along the western portion of the I-10 freeway in the Coachella Valley, Riverside County, California, will be evaluated for one year to determine whether they function as a linkage in facilitating wildlife movement between the Peninsular and Transverse Mountain Ranges. An additional objective is to determine whether variables such as the size and surrounding disturbance levels of these structures influence wildlife use. Results of this study will be used as pilot data for planning and implementing a more expansive study to identify generalized principles for effective corridor design in arid environments.

86. ADMINISTRATION OF DAIDZEIN, A SOYA DERIVED PHYTOESTROGEN, IS CORRELATED WITH AN INCREASE IN LIFESPAN WITHIN THE NEMATODE *C. ELEGANS*

J.M. Ochoa and S.A. Vetrone. Biology Department, Whittier College, Whittier, CA 90608.

In today's health market, many plant derived neutraceuticals claim to not only improve ones health, but also extend ones life. Isoflavones are one such group of neutraceuticals. Isoflavones are naturally occurring plant derivatives, that act as phytoestrogens (plant estrogen-like molecules) in humans, and have been shown to reduce reactive oxygen species (ROS) and decrease oxidative damage. Interestingly, in vitro studies have shown that increases in ROS and subsequent oxidative damage can result in shortened lifespan. The nematode model *Caenorhabditis elegans* (*C. elegans*) has been widely used to study the effects of oxidative stress and aging. This study aims to elucidate the effect of administering a soy plant phytoestrogen, Daidzein, on the life span of *C. elegans*. Our preliminary results demonstrated that when Daidzein is introduced as an additive the normal food regiment of *C. elegans*, their lifespan is prolonged by 46%, suggesting that Daidzein may serve as a lifespan extending neutraceutical. Similarly, further studies must be conducted to determine whether the beneficial effects of Daidzein on lifespan are due to a decrease of ROS and or oxidative damage, and by which mechanism this effect is taking place.

87. EARLY DEVELOPMENTAL EXPOSURE TO CHLORPYRIFOS AFFECTS THE CHOLINERGIC NERVOUS SYSTEM OF THE ZEBRAFISH

G. Orona, **F. Radoniqi**, S. Han, and E.A. Fradinger. Whittier College, Department of Biology, Whittier, CA, 90608.

Organophosphate pesticides are known to inhibit acetylcholine esterase, an enzyme that degrades acetylcholine at the cholinergic synapse. In this study *Danio rerio* (zebrafish) embryos, a widely utilized developmental model, were used to understand the impact of the organophosphate pesticide chlorpyrifos on the development of the cholinergic nervous system. *D. rerio* embryos were exposed at the pre-epiboly stage to concentrations of chlorpyrifos ranging from 1μM to 1mM and survival, spontaneous movements, heart rate, swimming behavior, and physical abnormalities were examined. Exposure of embryos to chlorpyrifos at concentrations greater than 100μM was lethal and resulted in death by 48 hours post-fertilization. At 24 hours post-fertilization, embryos exposed to 1μM and 10μM concentrations of chlorpyrifos exhibited an increase in spontaneous movements indicating hyperstimulation of the

neuromuscular junction by primary and secondary motor neurons. At 48 hours post-fertilzation, embryos exposed to 1 μM and 10μM concentrations of chlorpyrifos exhibited a decrease in heart rate. At 5 days post-fertilization, *D. rerio* larvae exposed to chlorpyrifos exhibited decreased swimming behavior and spinal curvature. These data demonstrate that early developmental exposure to chlorpyrifos has widespread effects on the cholinergic nervous system.

88. THE EFFECTS OF THERMAL STRESS ON FILTRATION RATES OF NON-NATIVE *CRASSOSTREA GIGAS* AND NATIVE *OSTREA LURIDA* OYSTERS

Sara Pfremmer and Patricia Gonzalez. Southern California Ecosystems Research Program (NSF-UMEB), California State University Fullerton, Department of Biological Sciences, Fullerton, CA, 92831.

Introduced species pose problems worldwide as they can displace native organisms that provide unique ecosystem functions. Successful establishment of non-natives can be related to their ability to out-compete native species. In southern California protected waters, the non-native filter-feeding oyster *Crassostrea gigas* may compete with the native *Ostrea lurida* for food and space. *Crassostrea gigas* is larger and has a higher thermal tolerance which may give it a competitive advantage over *O. lurida*. We studied the effects of temperature on filtration rates of both oysters and hypothesized that *C. gigas* would filter at faster rates per body weight than *O. lurida*, particularly following exposure to higher temperatures. We tested our hypothesis by exposing both oyster species to a simulated 3-hour low tide at air temperatures of 10, 20, 30 or 40 °C, temperatures characteristic of the study region. We returned oysters to individual jars (n=5 per treatment) with water containing single-celled algae (~2×10/\9 cells/mL) at 20 °C, the average water temperature of local oyster habitat. We sampled water from each jar after two hours, measured the algal concentrations using a spectrophotometer, and determined filtration rates. Non-native oysters filtered more per gram wet body weight than natives (Two-way ANOVA, $p=0.027$) but exposure to different aerial temperatures did not affect filtration rates ($p>0.05$). While both species cope with extreme temperatures in southern California, *C. gigas*'s higher feeding rates may make this introduced species a better competitor for food, possibly providing an ecological advantage over the native *O. lurida*.

89. EARLY ONSET OF THE LEGUME-RHIZOBIA SYMBIOSIS: DETECTION OF EARLY NODULIN GENE ACTIVITY IN *M.* TRUNCATULA SEEDS FOLLOWING NOD FACTOR EXPOSURE

G.A. Ramirez, B. Boschetto, and G. Brelles-Mariño. California State Polytechnic University, Pomona, Biological Sciences Department, Pomona, CA, 91768.

The Legume-Rhizobia symbiosis provides leguminous plants with reduced nitrogen forms that are directly incorporated into plant metabolic cycles. This symbiotic interaction implies a sustainable agricultural practice that fertilizes crops and remediates nitrogen depleted soils. The symbiotic interaction is mediated by a complex molecular dialogue between *Medicago* plants and their respective prokaryotic symbionts. Plant developmental changes needed for this symbiosis begin by the perception of rhizobial excreted signal molecules called Nod Factors (NFs). In mature *M.* truncatula root systems, the expression of early nodulin (ENOD) genes is triggered by exposure to NFs. Here we present results of the activity of *M.* truncatula ENOD genes, following NF exposure, in seeds. Surface sterilized *M.* truncatula seeds were exposed to a 10^{-8} NF solution for 6hrs under vacuum infiltration. Following NF exposure, total RNA was extracted from seed tissue and analyzed via RT PCR for the activity of the early nodulin genes ENOD11, ENOD12, ENOD16, ENOD20 and MtN21. So far, we have detected NF induced activity of at least one ENOD gene, ENOD20, in *M.* truncatula seeds. To our knowledge, this is the first time that ENOD gene activity has been detected at the seed level of plant development. These preliminary results suggest that NF perception mechanisms could be present at the seed developmental level and not be, as suggested by the current literature, exclusive to the root system found in mature *M.* truncatula plants. Additional work, including the analysis of other *M.* truncatula ENOD genes, will be needed to confirm these preliminary observations.

90. ECOLOGY AND BIOGEOGRAPHY OF THE ROCKY INTERTIDAL FISH COMMUNITY IN THE WESTERN COAST OF THE BAJA CALIFORNIA PENINSULA

Ramírez-Valdez A.[1], G. Ruiz-Campos[2], F. Correa-Sandoval[3], and E. Carpizo-Ituarte[3]. [1]Facultad de Ciencias Marinas, Universidad Autónoma de Baja California, Km. 103 Carr. Tijuana-Ensenada, AP 653, Ensenada, Baja California, 22800, México. arturorv@uabc.mx; [2]Colección Ictiológica, Facultad de Ciencias, Universidad Autónoma de Baja California, Km. 103 Carr. Tijuana-Ensenada, AP 233, Ensenada, Baja California, 22800, México; [3]Instituto de Investigaciones Oceanológicas, Universidad Autónoma de Baja California, Carr. Tijuana-Ensenada Km. 107, Ensenada, Baja California, México. 22890.

The taxonomical composition, ecological attributes and biogeographical aspects of the rocky intertidal fishes of the western coast of the Baja California peninsula, Mexico, were studied along 16 sites between Medio Camino (32° 10′ N) and Los Cerritos (23° 20′N), during June 2006 to February 2010. The rocky intertidal fish assemblage was composed by 42 species, 33 genera and 19 families. A discontinuous pattern in the ecological attributes of the fish community was recognized along the geographic gradient, which was mainly composed by those assemblages located within the Sebastian Vizcaino and Todos Santos bays. Woolly sculpin (*Clinocottus analis*) and opalaye (*Girella nigricans*) were the most abundant species both in the northern and central sub-areas, while the notchfin blenny (*Entomacrodus chiostictus*), Mexican night sergeant (*Abudefduf declivifrons*) and porehead blenny (*Labrisomus multiporosus*) dominated in the southern sub-area. Based on distribution and density of permanent species, the area encompassed between Punta Abreojos and San Juanico represents the distributional boundary for northern (warm-temperate) and tropical fish elements. Most of species (85%) have distributional ranges that include the California marine faunal region and its Californian province, followed by those species with distributions into the Mexican province (58%) of the Tropical Eastern Pacific Region and the province of Cortés (56%). The known northernmost geographical ranges are extended for *Muraena lentiginosa*, *Sargocentron suborbitalis* and *L. multiporosus*, *Bathygobius ramosus*; while the southernmost ranges extended for *C. analis*, *Oligocottus rubellio* and *Amphistichus koelzi*. The latitudinal gradient showed a significant correlation with the fish species diversity.

91. GEOCHEMISTRY AND METALS DISTRIBUTION IN SEDIMENTS OF SOUTHERN TOGO RIVERS WATERSHED, WEST AFRICA

Rezaie-Boroon M.H. California State University Los Angeles, Geological Sciences Department, CA 90032, mrezaie@calstatela.edu. Gnandi K. University of Lomé, Science Department, Lomé, Togo, West Africa, kgnandi@yahoo.fr. Tomety-Mensah Folly K. University of Lomé, Science Department, Lomé, Togo, West Africa, tomensfol@yahoo.fr.

The watershed in southern Togo, west Africa is important to fishery and irrigation in the region. Concentrations of selected metals in sediments samples in the Lomé coastal region were studied in order to determine the metal contamination due to industrialization, urbanization, and economic development in Lomé. Trace and heavy metal concentration in surface sediments varies from 130–829 µg/g for As, 16–125 mg/kg for Ba, 16–121 µg/g for Cd, 3–23 mg/kg for Co, 11–26 mg/kg for Cr, 3–23 mg/kg for Cu, 3–7 mg/kg for Pb, 5–44 mg/kg for Ni, 63–425 µg/g for Se, 10–35 for Va, and 6–26 mg/kg for Zn. The metalloid antimony as well as beryllium, silver, mercury, thallium, and molybdenum show a value of <2 mg/kg or little variation with regard to baseline concentration. Enrichment factors (EFs) and Index of geo-accumulation (I_{Geo}) were calculated to assess whether the concentrations observed represent background or contaminated levels. The highest level of metal was found at the confluence of the Mono and Haho Rivers, indicating the impact of the effluents of the industrial activity as well as hazardous waste dumping in the vicinity of Lomé. The arsenic retention in the sediments is highly variable and may be controlled by local processes such as weathering of metamorphic bedrock. Results indicate that the potential toxicity of marine environment can cause adverse biological effects to the biota directly and the human health indirectly through the food chain.

92. GEOCHEMISTRY AND SEDIMENTOLOGY OF EOCENE PHOSPHATE DEPOSITS IN WEST AFRICA

Rezaie-Boroon M.H. California State University Los Angeles, Geological Sciences Department, CA 90032, mrezaie@calstatela.edu. Ramirez P. California State University Los Angeles, Geological Sciences Department, CA 90032, pramire@calstatela.edu. Gnandi K. University of Lomé, Science Department, Lomé, Togo, West Africa, kgnandi@yahoo.fr.

The phosphorites in West Africa occur in the coastal basin of Togo/Benin of Tertiary age (Middle Eocene) composed of limestones, clay, sand and phosphorites. The thickness of the phosphate deposits varies from 1 to 10s of meters thick and consist mostly of moderately to poorly sorted phosphatized pellets, formanifera, and other bioclastic debris. Geochemically, the raw samples show significant enrichment in P_2O_5 and CaO. P_2O_5 concentrations vary from approximately 29 to 35.78 wt%. A strong correlation ($r^2 = 0.92$) occurs between CaO and P_2O_5 abundances indicating that apatite is a major control on the phosphate. A number of heavy metal elements and trace elements occur. Cr, V, Ni, Cu, and Cd are interpreted to be in phosphate minerals, largely apatite. Mean oxide compositions (wt %) are 31.27% P_2O_5, 43.74% CaO, 9.50% SiO_2, 4.30% Al_2O_3, 2.96% Fe_2O_3, 0.11% K_2O, 0.19% TiO_2, 0.02% MnO, 0.02% MgO, 0.02% Na_2O, and 6.12% LOI (loss of ignition). Our analysis shows that Cd, U, Th, and F are incorporated into the francolite. We conclude that the phosphorites in Togo formed under oxic, shallow-water conditions where microbial populations assimilated phosphorus primarily from seawater and mediated precipitation of calcium fluroapatite during early diagenesis at the sediment–water interface. Analysis of the mine tailings show that the purification process leads to the enrichment of certain metals (Cr, Cu, Ni, V, Zn, Ba, Sr, Fe, and Al) in the tailings due to their association with the clay minerals, whereas Cd, Th, and U are enriched in the purified apatite-rich product. Leaching tests show that the solubility of metals generally increases when salinity increases or when pH decreases. Thus, the processing of phosphorites with sea water and the dumping of phosphorite tailings into the sea represent a serious potential risk for the marine ecosystem and for human health through the food chain.

93. A STUDY OF MICROBIAL MAT CONIFORM STRUCTURES FOUND IN OCTOPUS SPRING, YELLOWSTONE NATIONAL PARK

Kristina Reyes, **David Cho**, Nahal Ghahremani, and Hope A. Johnson. California State University, Fullerton, Department of Biology, Fullerton, CA 92831.

In Octopus Spring, Yellowstone National Park, orange coniform structures can be found growing on the top of microbial mats. These coniform structures, which consist mainly of cyanobacteria, may be related to the fossil stromatolites found in the geological record, possibly elucidating important biotic and abiotic information of the early earth. Cyanobacteria, which naturally fluoresce red under green light, were predominantly found in the center of the cone structures rather than the top or bottom. Cyanobacteria were enriched using D medium. Two morphotypes of enriched cyanobacteria cultures grown in quiescent liquid media were observed – spherical and sheet-like aggregates. Since cyanobacteria can be found in abundance in the coniform structures, it is hypothesized that they are the main contributors to its morphology. However, preliminary observation of heterotrophic interaction with these cyanobacteria suggests that heterotrophs may also play a role in determining the formation of coniform structures. Heterotrophic isolates were obtained using various rich media, and identified by 16S rRNA gene analysis. To further explore the mechanisms through which the structures are formed, phototactic capabilities of the cyanobacteria and heterotrophs were also studied. As expected, cyanobacteria phototaxed when under constant light exposure, while heterotrophs did not display phototaxis. Coniform structures were successfully grown in Erlenmeyer flasks with an enriched cyanobacterial culture. Future experiments will examine the effects of signaling molecules and minerals on the morphology of liquid cultures and coniform structures.

94. LOSS OF VIRAL RESISTANCE RECOGNITION THROUGH MUTAGENESIS OF THE SILENCING SUPRESSPOR P0

D.S. Schafer and M. Sacco. Sacco Research Lab, California State University, Fullerton, Department of Biology, Fullerton, CA, 92831.

Plants use evolved molecular defense mechanisms to stop and prevent virus infection and spread. These mechanisms include RNA interference (RNAi), which degrades the virus' genetic information. Alternatively, the plant can elicit a hypersensitive response (HR), a type of cell suicide that causes the living cells to die around the site of infection, thereby preventing viral spread. Plant recognition and immunity to viruses is often through resistance genes (*R* genes) and the proteins they encode (R proteins). R proteins detect invading viruses and initiate resistance responses such as HR. A member on the *Polerovirus* genus known as the Beet Western Yellows Virus (BWYV) has evolved a means of suppressing the mechanism of RNAi. BWYV uses a protein known as P0 (P zero) encoded to target the host protein Argonaute, a key factor in RNAi, for degradation. As a counter measure, plants have evolved R proteins that recognize virus silencing suppressors such as P0 that disrupt RNAi and initiate HR. We have identified plants within the *Nicotiana* genus with resistance against BWYV conferred by R proteins that recognize P0 and induce HR. Our research goal is to characterize P0 through random mutagenesis to see which regions are necessary for this R protein recognition. Random mutagenesis will be conducted by error-prone polymerase chain reaction (PCR) to create a library of different P0 clones. Once recognition mutant clones are identified, they can be characterized by DNA sequencing and analyzed using existing data about protein residues and interactions to understand P0 protein function in recognition.

95. THE EFFECT OF WILDFIRE UPON WILD CANID VISITATION TO THE PORTUGUESE BEND NATURE PRESERVE

Peter Smolke[1], Alfred Fernandez[2], and Ann Dalkey[3]. [1]Palos Verdes Peninsula High School, Rolling Hills Estates, CA90274; [2]Harbor City College, Long Beach, CA, 90813; Palos Verdes Peninsula Land Conservancy, Rolling Hills Estates, CA, 90274.

The Palos Verdes Nature Preserve, located on the southern slope of the Palos Verdes Peninsula contains mostly coastal sage scrub habitat. Three wild canid species are known to be present within the Preserve, they are: coyotes (*Canis latrans*), red fox (*Vulpes vulpes*), and grey fox (*Urocyon cinereoargenteus*). In August of 2009, a wildfire burned approximately 165 acres of habitat within the 399-acre Portuguese Bend Reserve. This study was to assess the visitation to the preserve by the wild canid species within the 2009–2010 year set following the August 2009 wildfire, as compared to the pre-fire 2007–2008 year set. A field survey of sign, tracks and scat, was performed. The adjoining Forrestal Reserve, was also surveyed. We assumed that there would be a decrease in the activity of the wild canid species within the Portuguese Bend Nature Preserve following the wildfire. However, when coyote and fox visitation within the 2009–2010 year set was compared to the 2007–2008 year set, there was no significant difference. Data collected in the Portuguese Bend and Forrestal Reserves shows that wild canid activity is more abundant in those regions of the preserve that have a greater amount of mature habitat.

96. INVESTIGATION OF THE EFFECTS OF METHOXYCHLOR METABOLITE, HPTE, ON EMBRYONIC DEVELOPMENT OF T-CELLS IN C57BL/6

Dr. Christine Broussard and **D.M. Sortillon**. University of La Verne, Department of Biology, La Verne, CA, 91750.

Recent evidence has shown that pesticides have the potential to act as endocrine disrupting chemicals (EDCs), which can lead to autoimmune diseases such as asthma and allergies in children. These findings suggest that at lower concentrations of EDCs, observable effects are seen during embryological development, due to the fact that development is quite sensitive to hormone level fluctuations. Currently, the EPA does evaluate EDCs, but does not consider the impact of the EDCs on the developing immune system. Although numerous studies have been conducted on pesticide exposure, few studies have looked at metabolites from pesticides, with regards to immune system development. HPTE, a metabolite of Methoxychlor (MXC), has been found to have a 100 times more estrogenic effect than MXC. However, few studies have looked at the effects of the metabolite HPTE on embryological development. Therefore, our study used an in vitro assay to analyze the effects of HPTE on the prenatal development of the immune system. Various concentrations of HPTE within the EPA allowable limits of MXC, 1 to100 ppm, were used to observe HPTEs effect on T-cell differentiation in C57BL/6 mice embryos. Doses of 12.5 μM, 25 μM, and 50 μM reduced viability and altered thymocyte development in a dose dependent manner. In

addition, CD4 populations decreased and double positive and double negative populations increased significantly in a dose dependent manner. These results suggest MXC metabolite HPTE can alter normal T-cell differentiation at low dose exposure.

97. HERPETOFAUNA SURVEYS IN THE BALLONA WETLANDS

Benjamin Stava. Loyola Marymount University.

Herpetofauna surveys at Ballona Wetlands were designed to compare species abundances and diversity within different habitat types and at various locations. Herpetofauna surveys may also be used to determine ecosystem functions and health. Multiple surveys were conducted at the Ballona Wetlands to determine relative population densities and species presence for herpetofauna. Three trap arrays were set up at each of the three vegetation types (high marsh, seasonal wetlands, and uplands) for a total of 9 overall trap locations. Each herpetofauna array consisted of two survey methods: four pitfall traps with 21m of drift net fencing, and funnel traps. Herpetofauna traps were left out for 9 days and nights at each location.

Overall trap success during spring 2010 was much better than the surveys in the late fall 2010. This was largely due to warmer weather in April 2010 than in October/November 2009. With the warm weather, we saw an increase in overall activity which led to the higher capture rates in comparison to the rates in fall 2009. Lessons learned from problems experienced during the fall surveys were used to develop better strategies for these surveys, including the addition of funnel traps to survey the snake populations. Data from fall 2009 and spring 2010 surveys will be utilized to provide a baseline assessment for the Ballona Wetlands, and to develop restoration actions.

98. PARASITIC INFECTION OF THE VENTRAL EPIDERMIS OF *CROCODYLUS ACUTUS* AND *CROCODYLUS MORELETII* IN BELIZE

M. Tellez[1] and I. Paquet-Durand[2]. [1]Department of Ecology and Evolutionary Biology, University of California, Los Angeles, California, 90095-1606, U.S.A.; [2]Galen University, 62.5 Western Highway, San Ignacio, Cayo District, Belize.

Parasitic infections of *Crocodylus acutus* and *Crocodylus moreletii* were observed during bi-annual health examinations at the American Crocodile Education Sanctuary in Punta Gorda, Belize. Figures of parasites were imprinted on the epidermis on the ventral abdomen area, as well as zig zag scars caused by egg discharge into the external environment and movement of parasites. These observations are similar to a nematode known to infect the ventral scales of crocodiles in Asia, Australia, and Mexico. As a result this parasite was identified to be similar to *Paratrichosoma* (Nematoda: Capillaridae).

99. THE EFFECTS OF ILLUMINATION, SCENT, AND MICROHABITAT AS PREDATOR CUES ON THE FORAGING BEHAVIOR OF MOJAVE DESERT RODENTS

Bryan White and Anthony Garcia. Southern California Ecosystems Research Program (NSF-UMEB), California State University Fullerton, Department of Biological Sciences, Fullerton, CA, 92831.

Optimal foraging theory predicts that animals will forage in a given patch until the risks (e.g., predation) outweigh the benefits (e.g., food intake). We investigated how predation risk influenced foraging behavior in rodents near the Desert Studies Center, Zzyzx, California. We hypothesized that foraging would be inversely correlated with predation risk. Seed trays containing 4 g of millet seed mixed into 2 L of sand were used to assess the amount of seed removed by rodents. In order to create a gradient of predation risk, treatments consisting of light (illuminated vs. un-illuminated), scent (coyote urine, beaver gland, and water), and microhabitat (location of trays in shrubs vs. open) were applied. Sixty trays were placed over 2 nights and all possible treatment combinations were created. For instance, low-risk foraging areas

consisted of an unlit, water scent, shrub microhabitat. High-risk foraging areas consisted of an illuminated, coyote urine scent, open microhabitat. Quadrupedal mice (*Peromyscus* and *Chaetodipus*) comprised 32% and 60%, respectively, of the individuals captured over 147 trap nights on two 1.1 ha grids and were presumed to be the species that visited seed trays. There were no significant differences in the amount of seed removed based on illumination, scent, or microhabitat alone. However, rodents ate significantly less from the illuminated, open-habitat seed trays compared to dark, shrub trays (two-way ANOVA $p = 0.049$). Consistent with optimal foraging theory, rodents altered their foraging behavior when predation risk was high enough to outweigh the benefits of foraging in a given patch.

100. THE EFFECT OF CO-ADMINSTRATION OF GENISTEIN AND DAIDZEIN ON THE LIFESPAN OF THE NEMATODE *C. ELEGANS*

E.D. Zamora and S.A. Vetrone

Isoflavones are naturally occurring antioxidants that have been shown to reduce the presence of reactive oxygen species (ROS) that have been linked to a decrease in lifespan and immunity. Isoflavones are sold in many health food stores in markets around the world. Soya beans contain high amounts of isoflavones termed phytoestrogens (estrogen-like molecules) that have been shown to decrease ROS, but the main phytoestrogen responsible for these results has not been identified. *Caenorhabditis elegans* (*C. elegans*) is a versatile nematode model that is commonly used to study a wide variety of human conditions such as aging. Similarly, it has been shown that the Daf-2 insulin-like pathway plays a major role in determining the life span of the *C.elegans*. In this study, we investigated the effect of two soy phytoestrogens, genistein and daidzein, on longevity by co-administering them to *C. elegans* in their normal food regiment. Our preliminary results show that the co-administration of genistein and daidzein to *C. elegans* does not appear to effect lifespan when compared to their control feed peers. While these results suggest that the co-administration of these phytoestrogens may not directly alter lifespan, further studies must be undertaken to determine if single administration of each phytoestrogen will be able to exert any affect on lifespan. In addition, further studies must also me undertaken to address if either the co-administration or single administration of these phytoestrogens have an effect on oxidative stress and in particular, if these effects are directly targeting the Daf-2 pathway.

101. RECURRENCE REGULATION IN COLON CANCER: EXTRACELLULAR WNT SIGNALING DETERMINES RECURRENCE POTENTIAL THROUGH REDUCTION OF THE CLONOGENIC CELLS NUMBER BY INHIBITORS DKK1 AND SFRP1

A. Planutis. Dr. Holcombe's Lab, Hematology/Oncology, Department of Medicine, University of California, Irvine, CA, 92697.

In mice, extracellular Wnt inhibitors decrease colon tumor size in the absence of intracellular Wnt pathway mutations, but their influence on epithelial mesenchymal transition (EMT) and clonogenic cell growth is not known. Constructs expressing Wnt inhibitors DKK1 and sFRP1 are stably transfected into colon cancer cells RKO that contain no activating Wnt/beta-catenin mutations and HCT116B that has a mutant beta-catenin allele removed by homologous recombination. This removal does not change HCT116B clonogenicity (shown by others). Expression of DKK1 and sFRP1 is evaluated by real-time PCR; clonogenic potential is measured by colony growth in soft agar; EMT is estimated based on cell phenotype. RKO cells have no detectable expression of both DKK1 and sFRP1 mRNA; stably transfected RKO cells significantly increase the levels of these mRNA. The ability of these cells to form colonies decreases by 2.5-2 times. In HCT116B, DKK1 is elevated prior to transfection and it stays unchanged following transfection. HCT116B has minimal expression of sFRP1, which increases after transfection. DKK1 has no effect on clone formation in soft agar; sFRP1 decreases the number of clones by 2.8 times. Evaluation of cell morphology reveals that RKO stably transfected with either DKK1 or sFRP1 shows increased cell-cell contact formation suggesting more epithelial and less invasive phenotype. DKK1 and sFRP1 reduce clonogenicity of colon cancer cells that have no intracellular Wnt pathway mutations.

102. A STUDY OF RECENT GENETIC BOTTLENECTS USING INVASIVE GOBIES, *TRIDENTIGER BARBATUS* AND *TRIDENTIGER BIFASCIATUS*, IN SAN FRANCISCO BAY SUGGESTS A TEMPORALLY SHORT RECOVERY PERIOD

JoAnne Linnenbrink and Raymond R. Wilson, Jr. California State University Long Beach, Department of Natural Sciences, Long Beach, CA, 90804.

Genetic bottlenecking occurs when a large population dramatically shrinks in overall size. A useful model of genetic bottlenecking is when a small subsample of a population becomes invasive into a new environment. This population subsample brings with it a small subsample of the original genetic diversity. The coast of California has many examples of invasive populations; this study analyzes gobies that originated from East Asia that became invasive in San Francisco Bay. The study builds on previous ones which examined the chameleon goby *Tridentiger trigonocephalus*, introduced in 1960 and the yellowfin goby *Acanthogobius flavimanus*, introduced in 1963. We examined two other invasive gobies from San Francisco Bay; the shimofuri goby *Tridentiger bifasciatus*, introduced in 1985 and the shokihaze goby *Tridentiger barbatus*, introduced in 1996. If a population has gone through a recent genetic bottleneck, the genetic diversity should be lower compared to a population that went through an earlier one. We found haplotype diversity among the four species is significantly positively correlated with time since introduction ($y = 0.0279x - 0.1703$, $R^2 = 0.9401$,). These results show that if the date of appearance is not known, the order in which the species became invasive might still be detected. The haplotype diversity data supports that *T. bifasciatus* and *T. barbatus* are indeed founder populations that have gone through a recent and dramatic bottleneck while *T. trigonocephalus* and *A. flavimanus* are on their way to recovering lost genetic diversity over a fairly short temporal period.

103. PHENOLOGICAL AND PHYSIOLOGICAL RESPONSE OF AN INVASIVE SPECIES *CENTUAREA MELINTENSIS* UNDER DIFFERENT AMOUNTS OF SOIL NITROGEN SUPPLY

S.Y. Woo, J. Moroney, R. Sharifi, and P.W. Rundel. University of California, Los Angeles, Department of Ecology and Evolutionary Biology.

Plant invasions are widely recognized as significant threats to biodiversity conservation worldwide. They change the structure and function of ecosystems, most importantly, causing extinctions of native species. *Centaurea melitensis* (Malta Starthistle), the study species, is an annual invasive species that is found throughout most of California and many other western states. In this study, we are focusing on the phenological and physiological response of *Centaurea melitensis* in three different amounts of nutrient supply (0, 1.5, 3.0 and 6g of nitrogen). This research was conducted at the UCLA greenhouse. A portable steady state gas exchange system was used to measure the maximum rates of photosynthesis (P_{max}), transpiration, stomatal conductance to water vapor, internal carbon dioxide concentration, and the water-use efficiency. In addition, the lengths of the leading shoots, number of flowers, number of lateral shoots, and leaf characteristics were measured. It was found that there is a significant difference in the rates of photosynthesis in the treatments with 0g and 1.5g, 0g and 3g, 0g and 6g, and 1.5g and 3 g of nutrient addition. Similarly, the water-use efficiency of the three experimental and control groups were found to differ in the treatment with 0g and 1.5g, 0g and 3g, 0g and 6g, and 1.5g and 3 g of nutrients addition. Our study has implication to compare the impacts of anthropogenic nitrogen deposition on invasive and native species at the field.

104. SHOULD MITOCHONDRIAL DNA SEQUENCES BE USED IN PHYLOGENETIC STUDIES?

Donald G. Buth. Dept. of Ecology an d Evolutionary Biology, University of California (UCLA), Los Angeles, CA 90095-1606.

DNA sequence data have become the database paradigm in current phylogenetic studies. However, resultant sequence-based phylogenies are often at odds with phylogenies based on other databases including other gene sequences. Mitochondrial DNA and nuclear DNA have quite different properties, and some of the former violate prerequisites for phylogenetic application. As a symbiont, mtDNA is

extrinsic to its host's genome and is inappropriately used as a proxy for the latter. Mitochondrial DNA is inherited as a unit and can be subject to intact lateral transfer via hybridization, yielding a conflicting signal in regard to the phylogeny of the hosts. Mitochondrial DNA is useful in determining the direction of hybridization and perhaps at the population level (gamma). However, at the interspecific level (beta), mtDNA should be used only as a one-way test of hypotheses that are based on characters of the host, e.g. as applications of Hennig's Parasitological Method. Extrinsic mtDNA sequences should not be used as a primary database in phylogenetic studies, and should not be combined with intrinsic nuclear DNA sequences in "total evidence" analyses. All previous phylogenetic applications of mtDNA should be checked with nuclear DNA sequences and/or other intrinsic data.

105. EFFECTS OF DELAYED HATCHING ON MUSCLE AND SKELETAL DEVELOPMENT, SWIMMING ACTIVITY, AND FEEDING RATE IN LARVAL CALIFORNIA GRUNION, *LEURESTHES TENUIS*

T. Treybig, A. Carrillo, and K. Dickson. California State University Fullerton, Department of Biological Science, Fullerton, CA, 92834.

The California grunion, *Leuresthes tenuis*, spawns on sandy beaches during spring high tides. Fertilized eggs incubate in the sand for 9–14 days until wave action reaches them, which stimulates the embryos to hatch. Embryos are able to delay hatching to 30 days post-fertilization (dpf) at 20°C and hatch during subsequent spring high tides. We hypothesized that delayed hatching would result in additional muscle and skeletal development, resulting in larvae with greater swimming activity and feeding rates. For the developmental variables, gametes from a single male and female were fertilized and incubated in the laboratory at 20°C. Embryos were hatched at 10 and 28 dpf. The 28-dpf larvae were significantly longer and had significantly more dentary and pharyngeal teeth, and more cartilaginous precursors of the caudal fin skeleton. However, neither the percentage cross-sectional area composed of slow and fast locomotor muscle nor swimming activity differed significantly between 10- and 28-dpf larvae. The 28-dpf larvae did consume more rotifers, *Brachionus* sp., during a 4-h period, which may result from their more advanced state of tooth development. These consequences of delayed hatching may offset the known negative effects of decreased hatching rate and energy reserves, and thus may affect larval survival and recruitment to adult populations.

106. ECOPHYSIOLOGICAL STUDY OF RUSCUS ACULEATUS AND R. MICROGLOSSUM: MORPHOLOGY, GAS EXCHANGE, AND HYDRAULICS

A. Pivovaroff, R. Sharifi, L. Sack, and P. Rundel. UCLA, Department of Ecology and Evolutionary Biology, Los Angeles, CA, 90095-1606.

The genus *Ruscus* (Ruscaceae) consists of evergreen, woody monocot shrubs with phylloclades. Stem photosynthetic plants are usually found in arid environments with high light availability; *Ruscus*, however, is found in dry, shaded woodland area of the Mediterranean Basin and northern Europe. The drought and shade tolerance of Ruscus challenges the "tradeoff model," which suggests that plants can be either drought adapted or shade adapted, but not both. In order to understand the mechanisms that enable *Ruscus* to survive in shaded-drought environments, we selected two species, *R. aculeatus* and *R. microglossum*, in the Mildred E. Mathias Botanical Gardens at the campus of UCLA. We studied form-function relations, which included over 35 traits, focusing on plant morphology, gas exchange measurements, and hydraulics. We then compared these traits to other phylloclade bearing or stem photosynthetic plants and woody evergreen shade tolerant and intolerant plants found in published data to determine to what degree *Ruscus* shows combined shade and drought tolerant traits. *R. aculeatus* and *R. microglossum* showed both clear drought and shade tolerant characteristics that confer simultaneous adaptation to drought and shade as they require low light and water. These traits include thick phylloclades with low rates of maximum assimilation, low respiration, low light compensation points, low stomatal conductance, low cuticular conductance, low hydraulic conductance, and low modulus of elasticity associated with internal water storage tissue. *Ruscus* appears to be highly specialized both physiologically and morphologically to occupy shaded-drought regions across a wide geographical range, including extremely low resource understory sites.

107. INCORPORATING ANIMAL BEHAVIOR AND ENVIRONMENTAL EDUCATION INTO CONSERVATION BIOLOGY

D.T. Richardson. Narguizian Lab, California State University, Los Angeles, Department of Biological Sciences, Los Angeles, CA, 90032.

Reintroduction of captive animals—used in bolstering threatened, wild populations—is being explored as a way to aid vulnerable seahorses. Previously reintroduced organisms have not always had the same behaviors as their wild counterparts, which caused significant concerns after reintroduction. Due to the high cost of live food, captive seahorses are promptly weaned onto a frozen diet, very different from their natural live prey. To determine if the weaning process affects the behavior and food preference of a potential reintroduction species, I recorded and analyzed the behavior of *Hippocampus ingens*—captive-raised to maturity at the Cabrillo Marine Aquarium (CMA)—feeding on live and frozen foods. These post-weaned seahorses prefer frozen food ($p<0.001$) and their feeding behavior is significantly altered by the weaning process: they act as scavengers instead of ambush predators. This discrepancy in behavior can directly affect the survival of the seahorses upon reintroduction and possibly change their ecological niche. This work will help prepare reintroduction animals for survival and to fulfill their ecological niche, ensuring the long-term success of conservation efforts. Another aspect of long-term success is environmental education. In addition to understanding human impact and ways to help, it is important for the public to understand the role of science for the continued support of research and conservation. Complementing my research, I developed an interactive, educational activity for K-12 students and the public, based on the 5E model, introducing research, behavior and their application to conservation. This program is currently being implemented and evaluated at CMA.

108. GENETIC VARIATION IN POPULATIONS OF THE INTRODUCED EASTERN FOX SQUIRREL (*SCIURUS NIGER*) IN CALIFORNIA

S. Claytor, A. Muchlinski, and E. Torres. California State University-Los Angeles, Department of Biological Sciences, Los Angeles, CA 90032.

Eastern fox squirrels have been introduced to many urban areas within the western United States. In general, very little is known regarding the number of introductions to a given area, the location within the natural range from which the founding animals were obtained, or the size of the founding population(s). We used sequence data from the D-loop region of mtDNA to 1) determine the level of genetic variation within populations of eastern fox squirrels within the Los Angeles and San Francisco East Bay metropolitan areas, 2) determine the most plausible number of introductions to each area, 3) determine if haplotypes are shared between the two areas, and 4) determine the relationship of haplotypes found in California to haplotypes found in the eastern United States. Eight haplotypes were found in the Los Angeles area and three were found in the East Bay area of San Francisco. No haplotypes were shared between the two areas. There have been multiple introductions, from multiple sources, into the two areas of California.

109. THE EASTERN FOX SQUIRREL AS AN INVASIVE SPECIES: APPEARANCE AT RANCHO SANTA ANA BOTANIC GARDEN, CLAREMONT, CA

B. Gatza and A. Muchlinski. California State University-Los Angeles, Department of Biological Sciences, Los Angeles, CA 90032.

A population of western gray squirrels (*Sciurus griseus*) existed on the campus of California State Polytechnic University in Pomona, CA for over 40 yrs. Although this population was replaced by introduced eastern fox squirrels (*Sciurus niger*) over a period of three years, detailed information on changes in population size over time were not obtained. The current study follows the appearance of *S. niger* at Rancho Santa Ana Botanic Garden in Claremont, CA, where a population of *S. griseus* has existed for many decades. We are conducting a monthly census of both species of tree squirrels using three transect lines within the Botanic Garden. We report on the change in the population size of *S. griseus* and *S. niger* over a period of eight months. The number of *S. niger* has gradually increased over time with

juvenile animals first observed in November of 2009. The number of *S. griseus* has fluctuated over time but the number has not decreased as rapidly as at Cal Poly Pomona. This study is a field test of a Habitat Suitability Model to determine if the Botanic Garden will be a coexistence site for the two species of tree squirrels or whether *S. niger* will replace *S. griseus* at the location

110. FACTORS THAT ALLOW THE NATIVE WESTERN GRAY SQUIRREL (*SCIURUS GRISEUS*) AND THE INTRODUCED EASTERN FOX SQUIRREL (*SCIURUS NIGER*) TO COEXIST IN CERTAIN HABITATS WITHIN SOUTHERN CALIFORNIA

S.M. Lewis and A.E. Muchlinski. California State University-Los Angeles, Department of Biological Sciences, Los Angeles, CA 90032.

A habitat suitability model was developed to predict habitats which would support coexistence of native western gray squirrels (*Sciurus griseus*) and introduced eastern fox squirrels (*Sciurus niger*) and in which habitats *S. niger* would replace *S. griseus*. Two types of habitats were studied: 1) habitats with a historical record of supporting *S. griseus*, but now the habitat only supports *S. niger* and 2) habitats that currently support both species with coexistence for six or more years. We compared vegetative structure of the habitats including 1) density of trees; 2) percent of habitat covered by tree canopy; 3) number of different tree species; 4) number of closed canopy areas per hectare; 5) mean number of trees per closed canopy area; 6) mean density of trees within closed canopy areas; 7) percentage of trees that were oaks; and 8) percentage of trees that were deciduous. Data were analyzed using Discriminant Analysis. The variable "Percentage of Trees that were Deciduous" accounted for 61.8% of the total variance between the types of habitats while the variable "Percent of Habitat Covered by Tree Canopy" accounted for 14.8% of the variance. Study sites with 47.6% or more of the habitat covered by tree canopy supported both species as long as 18.0% or fewer of the trees were deciduous.

111. CHANGING SEXES IN A COMPLEX ENVIRONMENT - SHIFTS IN SKELETAL MYOSIN ISOFORMS IN COASTAL POPULATIONS OF CALIFORNIA SHEEPHEAD

J.N. Bartlett, K.M. Loke, K. Young, C. Lowe, and B.C. Rourke. California State University, Long Beach, Department of Biological Sciences, Long Beach, CA 90840.

Myosin heavy chain (MyHC) isoform expression was investigated in California sheephead, *Semicossyphus pulcher*, a protogynous hermaphroditic fish found in coastal Southern California and Northern Mexico. This species was collected from nine capture sites near the Channel Islands where both overall size, and size of individuals at the transitional sexual stage, varies considerably. We therefore cloned MyHC isoforms and analyzed proteins by SDS-PAGE to determine if gender, size, water temperature, or geographic location influenced contractile protein expression. The relative percentage of the slow MyHC isoform increased as sheephead transitioned from female to male with the highest expression of slow MyHC isoform observed in male sheephead. The lowest expression of slow MyHC was seen in Northern and off-shore female populations, when compared to Southern and near-shore female populations. Relative percentage of slow MyHC isoform positively correlated with standard length. No significant differences were observed between red mid-line and white body wall MyHC expression. Swimming fins had the highest expression of slow MyHC overall. Thus, in this interesting system where muscle mass undergoes dramatic growth accompanying gender transitions, MyHC isoforms are likely influenced by both sexual development and environment.

112. VENUS: EARTH'S TWIN PLANET AND ABSENCE OF SURFACE OCEANS

Kent D. Trego. Center for Planetary Oceans, Nautilus Oceanic Institute, La Jolla, California 92037.

There were two major planetary formation processes in the inner solar system which resulted in the formation of the planets Venus and Earth. Remaining pre-planetary material for these two planetary formations resulted in the formation of the smaller planets Mercury and Mars. Although Venus seems to be the twin planet for Earth being similar size, composition and with a significant atmosphere, it lacks

surface oceans. Although oceans on Venus have been vaporized by a runaway greenhouse effect, paleo-oceans may have existed for as much as 2 b.y. early in the planet's history. Clouds in the atmosphere of Venus could have reflected enough sunlight over time to allow oceans to have formed and existed long enough for an ocean ecosystem to evolve. There may have been enough water on the surface of Venus to allow a global ocean coverage of 100 meters.

113. CONSIDERATION OF INTERNAL OCEANS IN THE MOONS OF SATURN AFTER THE CASSINI MISSION

Kent D. Trego. Center for Planetary Oceans, Nautilus Oceanic Institute, La Jolla, California 92037.

Before the Cassini mission to the Saturn system, only the moons Titan and Rhea were thought to possibly have internal oceans. Titan's internal ocean is thought to be 100 km below the surface and is at least 200 km in thickness. Internal heat-generating radioactivity could create an internal ocean in Rhea. Pre-Cassini imagery of Rhea put it in a category with the Uranus moons Titania and Oberon. Specifically, moons with possible radioactive heat-generated internal oceans but with low levels of cratered terrain resurfacing. Cassini radar imagery of Titan showed topographic landmark shifting and, therefore, a decoupled crust from Titan's core by an internal ocean layer. Cassini imagery also showed water plumes out of surface fractures in the south pole of the Saturn small moon Enceladus. The size and state of an internal ocean in Enceladus is of continued debate. Cassini imagery of Rhea provided further evidence the the cratered terrain on Rhea has had limited resurfacing.

114. THE DWARF PLANET CERES AND THE POSSIBILITY OF OF AN INTERNAL OCEAN

Kent D. Trego. Center for Planetary Oceans, Nautilus Oceanic Institute, La Jolla, CA 92037.

The dwarf planet Ceres is found in the asteroid belt. Ceres has a width of 950 km at its equator and has 25 percent of the total mass in the asteroid belt. Ceres is thought to have a differentiated interior with a silicate core and water ice mantle. It has been speculated that Ceres may have aninternal ocean and may have been a source for life on Earth. Previous research suggests Ceres may have an internal ocean if ammonia or some other ice melting point depressent was incorporated during melting. Europa and Enceladus are outer planetary moons with obvious internal oceans and both moons are heated by significant planetary tidal forces. Ceres is not influenced by tidal forces and there is no evidence to suggest that the dwarf planet was ever acted upon by tidal forces. Bright areas on the surface of Ceres are probably result of recent impact events uncovering crustal ice. There is no direct evidence to suggest that Ceres has or ever had an internal ocean. The NASA DAWN Mission spacecraft will provide images of Ceres in 2015 and evidence of an internal ocean may be found.

115. COMPARISON OF THE EFFECTIVENESS OF TRANSCUTANEOUS ELECTRICAL NERVE STIMULATION AND ACUPUNCTURE ON LOWER BACK PAIN

Michelle Zhao. 4911 Maplewood Avenue LA, CA 90004.

Abstract.- The short term and long term effectiveness of two different treatment methods, Transcutaneous Electrical Nerve Stimulation(TENS Unit) and Acupuncture, on lower back pain were analyzed. The participant pool consisted of a number of different ethnicities and ages. Twenty three subjects were treated with the TENS Unit and twenty five subjects were treated with Acupuncture. All were treated consistently ten times. Their lumbar flexion, lumbar extension, lumbar left lateral bending, and lumbar right lateral bending were measured before the treatment, right after the treatment, and after the tenth treatment. These measurements were compared to normal measurements and taken as a percentage. The average percent improvement for each group was used to determine the effectiveness of each treatment both in the short term and in the long term. According to the data gathered, there have been significant changes in pain severity ($P \leq 0.01$) among subjects treated with either method. However,

the Transcutaneous Electrical Nerve Stimulation appears to have induced a higher average percentage of improvement compared to Acupuncture. Thus, Transcutaneous Electrical Nerve Stimulation has been shown to be more effective in increasing lumbar range of motion and pain severity in comparison to Acupuncture Treatments, in both the short term and long term.

116. REDUCING POLLUTION THROUGH GREEN ROOFS: A PHOTOSYNTHETIC STUDY

C.A. Frost. Drennan Biology Lab, Loyola Marymount University, Department of Biology, Los Angeles, CA.

This study evaluates indigenous, drought-resistant plants that would optimize the collection and storage of carbon dioxide for green roof applications in Southern California. The purpose is to find the plant that has the fastest photosynthetic rate of the following four native Southern Californian plants: *frageria californica*, *galvezia speciosa*, *heteromeles argutifolia*, and *salvia clevelandii*. The photosynthetic rate as well as the rate of transpiration was measured by a LI-COR 6400XT Portable Photosynthesis System, in the lab of Dr. Phillipa Drennan at Loyola-Marymount University. Five plants per species were tested to limit the influence of experimental error. Once the temperature and pressure were calibrated, each plant was tested at eight different flux levels: 1,800 micro moles per meter squared per second, then 1,500, 1,200, 900, 600, 400, 200, 100, and zero or no light. The results of the study showed that *Frageria californica*, the wild strawberry, had the most carbon dioxide processed and therefore the fastest photosynthetic rate: 1.3% more than *salvia clevelandii* and 40.2% more than *galvezia speciosa*. *Frageria californica* also had the steepest slope of the light response curve. *Frageria californica's* slope was on average 6.8% greater than *galvezia speciosa* and 40.1% greater than *salvia clevelandii* for the illumination range 1 to 100 micro moles per meter squared per second. For the illumination range of 200 to 600 micro moles per meter squared per second, *salvia clevelandii* had the steepest average slope at 5.4% more than *frageria californica*.

Galvezia speciosa reached its steady consumption of carbon dioxide level at an illumination level of 400 micro moles per meter squared per second, the swiftest of all the plants tested. *Frageria californica* reached the steady consumption level at 900, and *salvia clevelandii* at 1,200.

117. HIDDEN IN PLAIN SIGHT: IDENTIFICATION AND DESCRIPTION OF A NEW SPECIES OF *SPURILLA* WITH A PROPOSED MECHANISM OF SPECIATION

Bonnie R. Lei. Walnut High School, 400 North Pierre Road, Walnut, CA 91789; Department of Biological Sciences, California State Polytechnic University, Pomona, 3801 West Temple Avenue, Pomona, CA 91768-4032.

Through both morphological and molecular analyses of tropical Atlantic and Pacific populations of *Spurilla neapolitana* (delle Chiaje, 1941), the first such study conducted in the Aeolidiidae family, a cryptic species was identified in the Bahamas.

Maximum likelihood phylogenetic trees (100 bootstrap replicates) constructed from hypervariable 16S rRNA and highly conserved H3 histone gene sequences revealed the Bahamas population of *S. neapolitana* to be in a separate clade from all other *S. neapolitana*. Qualitative morphological evaluation of diagnostically reliable features including the external morphology, radulae, and reproductive system through scanning electron micrographs, camera lucida drawings, and digital photography corroborated the genetic findings. Radulae were further analyzed quantitatively with a Mann-Whitney U-Test ($P=0.01$) of cusp and denticle length and width ratios and the statistical data confirmed qualitative observations.

With a comparison to *S. neapolitana* and other aeolid species, this new species is here described with a proposed mechanism for speciation. By utilizing a molecular clock constructed using the Langley-Fitch likelihood method, the divergence of this new species from *S. neapolitana* was determined to be 5.88 million years ago (mya). Paleogeographic data indicate that during this time, from 5–6 mya, the closure of the Havana-Matanzas Channel restricted ocean current flow in the Caribbean and caused a separation between the Bahamas population and the rest of *S. neapolitana*, which likely led to subsequent speciation. These results provide crucial insight into the biodiversity of this genus and provide a better understanding of how geological phenomena affect the evolution of marine populations.

118. AUTONOMOUS ROBOT MODELING OF BACTERIAL MOTION AND CHEMOTAXIS

Kenny Lei. Walnut High School, 400 N. Pierre Road, Walnut, CA 91789. Harvey Mudd College, 301 Platt Boulevard, Claremont, CA 91711.

Some forms of bacteria have flagella to move through water and have two movement phases: straight swim and random tumbling. Certain forms continuously transition between the movement phases, while other bacteria, such as *E. coli*, employ chemotaxis to decide between movement phases. Chemotaxis is a process in which bacteria direct themselves toward highly favorable areas of food by either straight swimming when conditions are improving or randomly tumbling to reorient themselves when conditions are unfavorable. A comparison between the completely random movement method and chemotaxis movement was made. In addition, an evaluation of how frequently to check food concentrations and decide between transitioning was completed. Finally, the effects of external disturbances on bacteria were explored. Due to the complexity of creating a bacterial environment with a wide range of food concentrations, a bacterium was modeled using an autonomous robot created with the Arduino platform and programmed in Python. The modeled environment contained a dynamic gradient of light levels that represented food concentrations in a bacterial environment. Findings show chemotaxis movement performs better than completely random movement by an average of 57 percent. Furthermore, checking food concentration levels every 0.5 seconds was the optimal frequency and resulted in the highest average light level. Additionally, external disturbances caused detrimental effects on collecting light for the chemotaxis movement while having minimal effects on the completely random movement. This model demonstrates that random movements are not random: there is a clear evolutionary benefit of chemotaxis movement and the frequent checking of concentration levels.

119. DETECTING ANTIBIOTIC INSENSITIVITIES IN WETLAND BACTERIA

Steven Hoffman. Milken Community High School, Los Angeles, CA. Research with: Dr. Gary Kuleck and Dr. John Dorsey, Departments of Biology and Natural Science, Loyola Marymount University, Los Angeles, CA.

The purpose of this study was to analyze waterborne bacteria isolated from Del Rey Lagoon, Playa del Rey, Los Angeles for antibiotic insensitivities. Surface water samples were gathered and tested for coliforms and *Enterococci* levels and later cultured on tryptic soy agar (TSA) non-selective media. These plates were then replicated onto TSA plates containing clinically relevant concentrations of antibiotics. All replica plates were photographed and those plates containing colonies with 2 or more antibiotic insensitivities were recorded. Colonies with 3 or more insensitivities were re-grown on antibiotic-containing plates for validation. This study is a work in progress, with more specific resistance testing and species identification of multiple-resistant colonies in the future. Bacteria harboring multiple antibiotic resistances pose a serious worldwide medical and public health problem.

120. THE EFFECT OF PHOTOSENSITIZATION OF FULLERNE-BASED NANOPARTICLES ON REACTIVE OXYGEN SPECIES GENERATION AND TOXICITY TO VIRUSES IN VARIOUS AQUEOUS ENVIRONMENTS

Sumit Mitra. University High School, Irvine, CA 92612, Research with: Center for Environmental Implications of Nanotechnology, Duke University, Durham, NC.

With their unique catalytic and degrading capabilities, fullerene based nanoparticles (FNP) have had an increasing presence in consumer and commercial products. However, the potential benefits of these nanoparticles have not been weighed against their environmental implications. When FNPs undergo photoexcitation from the sun they produce toxic reactive oxygen species (ROS). The environmental impact of this toxicity needs to be further understood and therefore this study is the first to: 1) understand the role of FNP aggregation on the production of ROS in synthesized and natural environments 2) understand the role of aging of FNPs on aggregation and ROS production in synthesized and natural environments 3) Assess the toxicity of FNPs on the inactivation of T-7 bacteriophage which are found in aqueous environments. The project focuses on the generation of two predominant forms of ROS: singlet oxygen

and superoxide. After TEM imaging was taken and the samples were tested over distinct time intervals, it was found that in the presence of salts, nanoparticle aggregation increased, and ultimately reduced ROS generation. Furthermore, it was noted that humic acid seemed to inhibit ROS production as it probably shielded the FNPs from UVA light. In addition, because of its low concentration, it was evident that FNPs had limited inactivation on the virus. This leads one to believe that the toxicity of nanoparticles may not be too damaging if released in low concentrations into the environment. However, further research needs to be conducted on the ecological impact of the aggregation of these nanoparticles to assess fully how safe the FNPs are.

121. PROPARGYL METHYL ETHERS: NOVEL PRECURSORS TO COBALT-COMPLEXED PROPARGYL CATIONS

Sarine Shahmirian and Gagik G. Melikyan. California State University Northridge, Department of Chemistry and Biochemistry, Northridge, CA, 91330.

The generation of transition metal-stabilized organic cations under *neutral conditions* has long been sought after in the field of organometallic chemistry. Traditionally, unsaturated organic ligands are treated with strong Lewis acids, such as tetrafluoroboric acid (HBF_4). This method, however, is inapplicable for substrates containing functional groups sensitive to acids, in particular benzyloxy and acetal groups. The novel method for the generation of $Co_2(CO)_6$-complexed propargyl cations *under neutral conditions* was developed: employing the metal-bonded methyl propargyl ethers as substrates and triflic anhydride as a reagent. Ionic propargyl triflates are formed *in situ* as intermediates, due to successive nucleophilic substitution reactions. The transition of these reactive intermediates to the respective propargyl radicals readily occurs at 83°C (3–6 min), by way of the cluster-to-cluster and cluster-to-ligand single electron transfers. The carbon-carbon formation alpha to the metal clusters affords polysubstituted 3,4-diaryl-1,5-alkadiynes in high yields (>80%) and excellent *d,l*-diastereoselectivity (89–97%). The scope of the reaction was expanded by involving topologically diverse propargyl ethers, particularly those containing methoxy groups on the periphery of the aromatic nuclei.

122. ROLE OF SACCHARIDES IN THE IDENTIFICATION OF *SACCHAROMYCES CEREVISIAE* CLUMPING

Laurine J. Shahmirian and Steven B. Oppenheimer. California State University Northridge, Department of Biology and Center for Cancer and Developmental Biology, Northridge, CA, 91330.

The clumping of cancerous cells in the host's body has proven invaluable to the ongoing study of this currently incurable disease. Research has shown that in cancer spread, cancer cells in clumps often survive better in the bloodstream than single cancer cells. By testing different factors which may influence clumping, this study offers novel means for the stagnation of such clumping and further, the spread of cancer itself. *Saccharomyces cerevisiae* is a species of budding yeast most intensively studied as a model eukaryotic organism in molecular and cell biology. For the purposes of this experiment, this type of yeast is being used to represent cancer cells due to the complex internal cell structure it shares with the cells of plants and animals. Saccharides (carbohydrates), specifically d-lactose, d-galactose, d-fructose, d-mannose, and l-methyl glucose were tested as factors to influence the yeast cell clumping. Four drops of yeast and distilled water solution were placed systematically onto a microscope slide. Then, four toothpick tips full of a certain sugar were dissolved into two of the four drops and the other two drops served as the control. For thirty minutes, between 10 minute time intervals, the drops were observed under a microscope for evidence of clumping or disassociation of the yeast cells. Results show that the more complex disaccharides like lactose clumped the yeast cells more quickly and effectively than the more simple monosaccharides.

123. THE EFFICIENCY OF'DIET AND EXERCISE COMBINED TO CONTROL TYPE 2 DIABETES VERSUS METFORMIN ALONE, DIET ALONE, EXERCISE ALONE, OR A COMBINATION OF METORMIN AND EXERCISE

Ariel J. Hawley. Palos Verdes High School, Palos Verdes Estates, CA, 90274.

This study observed the most effective treatment of reversing the effects of type 2 diabetes. The effects of diet, exercise, and Metformin, a FDA approved drug used to treat diabetics, and different combinations of the three treatments, including Metformin and exercise, and diet and exercise, were observed and recorded after an extended period of time. Hemoglobin (HbA1c) and FPG (fasting plasma glucose) levels were closely monitored and showed the most improvement when patients were put on a strict exercise program that lasted 2 months, to reduce these levels as well as blood pressure and cholesterol. Specifically, a Progressive Resistance Training program was used as the exercise control. Carbohydrates were identified as the greatest single stimulus for type 2 diabetes. Overall however, exercise was the most beneficial means of treating type 2 diabetes for the body because it not only maximized the body's use of the insulin it produced, but also led to body fat reduction, muscle gain, lower blood pressure, cholesterol, and HbA1c levels, and an increase in bone density. Exercise alone significantly reduced one half of the measurements that were recorded and analyzed, while several other controls such as Metformin alone, diet alone, and a combination of diet and exercise each reduced one measurement. The results of this study were reached by analyzing data collected by Dr. Cynthia Williams from the South Bay Endocrinology Center from December 2009 to February 2010.

124. THE EFFECT OF LICORICE ON THE MOUSE HIPPOCAMPUS

Alexa Aranjo. University of Southern California, Department of Biological Sciences, Neurology and Biomedical Engineering, Los Angeles, CA 90089.

Throughout the world, licorice (*Glycyrrhiza glabra*) has been used to treat coughs, reduce inflammation, heal ulcers and stomach inflammation, control blood sugar, and balance hormones.

An *in vivo* mouse model was used to qualitatively assess the effects of licorice extract. Four CAFI (calpain activity monitored by FRET imaging) male mice were used. Two test mice had 20 grams of food pellets with 2 ml of licorice extract painted on and 200 ml of water with an additional 2 ml of licorice extract. Visual acuity testing was conducted periodically during the 24 hour observation.

After observation, a microdissection of the two control mice's brains was conducted. The micro dissection included the removal of the cerebellum and occipital lobes, with the remaining brain being the hippocampus.

The hippocampal test slices were then soaked in a licorice solution of 2 ml licorice extract and 10 ml of aCSF (artificial cerebrospinal fluid). A spectrofluorometer, with an excitation wavelength of 320 nanometers, was used to view calpain activity through FRET (fluorescence resonance energy transfer) imaging. Emission wavelengths were monitored at 480 nanometers.

Results showed that calpain, a protease that breaks protein into inactive fragments when activated, was not activated, but the licorice extract did induce higher activity levels in the mice. In the central nervous system, calpain has been involved in cell migration, axonal growth, neurodegeneration, and synaptic plasticity. The morphology and density of dendritic spines are regulated during synaptic plasticity; dendritic spines are specialized morphological compartments that are responsible for post-synaptic activity for a vast majority of excitatory synapses in the central nervous system.

125. MITOCHONDRIAL ACTIVITY AND AUTOPHAGY RESPONSE IN MYOBLASTS

Brian Diep[1] and Toshifumi Tomoda[2]. [1]San Gabriel High School; [2]Beckman Research Institute of City of Hope.

Skeletal muscle atrophy is linked to many pathological conditions, including myopathy, diabetes, cancer cachexia, and denervation due to motor neuron death. Recently, the autophagy/lysosomal system, a bulk degradation machinery in cells, has emerged as an important cellular mechanism underlying muscle atrophy. Here we show that autophagy-related gene, *Unc51.1/Atg1*, is upregulated upon denervation-induced muscle atrophy. Knocking out *Unc51.1/Atg1* in mice results in attenuated muscle atrophy upon denervation. In addition, loss of Unc51.1/Atg1 in primary myoblast cultures results in a higher rate of ATP production upon cellular stress such as nutrient starvation. These lines of evidence demonstrate that controlling autophagy activity may prove beneficial for maintaining cellular homeostasis in atrophying muscles, and suggest that Unc51.1/Atg1-mediated autophagy pathway could serve as a potential therapeutic target for treating muscle atrophy.

126. AN ANALYSIS OF COLIFORM BACTERIA LEVELS IN THE BALLONA CREEK

A.R. Kelleghan. Notre Dame Academy, Los Angeles, CA and University of Southern California, Los Angeles, CA.

This project was conducted to determine whether or not the Del Rey Lagoon is a major source of contamination in Ballona Creek. Ballona Creek has been cited as a highly impaired creek, and this experiment examines the validity of one explanation for high levels of contamination. Del Rey Lagoon, Ballona Creek, and the ocean were all sampled during dry weather and during rainfall and tested for E.coli, salinity, pH, and density. Water samples were collected throughout two miles of the creek. High levels of E.coli bacteria had a direct correlation with the increase in precipitation. Without any rainfall, E.coli bacteria were significantly decreased. This research has shown that Del Rey Lagoon is not a source of bacterial contamination. However, high levels of bacteria were found further up the creek. E. coli had an inverse correlation with the salinity which suggests that the bacterial contamination comes from the creek's freshwater sources such as from storm drain runoff.

127. CARBON SEQUESTRATION WITHIN AN ACRE OF *RHUS INTEGRIFOLIA*

Kevin Wen. Palos Verdes Peninsula High School.

Since the Industrial Age, there has been an increase in green house gas, especially carbon dioxide and monoxide, in the atmosphere. Excess carbon dioxide is harmful in many ways; including ozone deterioration, respiratory problems, and global warming. Thus, scientists have worked strenuously to try to reverse this process, hoping to return the amount of emission from our current 390 ppm to a healthier 280 ppm.

One of the most common and efficient method in reducing carbon dioxide is photosynthesis. Even though all plants naturally perform this process, not all of them sequester carbon as efficiently as each other. One example of a potentially successful reagent in this process is *Rhus Integrifolia*, commonly known as Lemonade Berries. *Rhus* possesses many unique traits that allow it to adeptly perform carbon sequestration. Not only can it be grown in abundance, but it also does little to harm the environment, only helping it with its ability to transport carbon from the atmosphere into the ground.

However, testing plants for large acres of territorial sequestration are not new, and have been tested on several other subjects. For example, this same process that is being tested on *Rhus Integrifolia* has also been tested on Red Wood Trees from the National Forests sprawled out across America. Red Wood Tress are the most common species used to promote carbon sequestration, because of its efficiency in absorbing majority of carbon dioxide and monoxide from the air, converting it into oxygen, and disposing the rest of the carbon offset into its root. However, why is this "perfect" tree not able to successfully remove a large portion of carbon from the air? The fact is: Red Wood Trees take a long period of time to grow and covers huge sections of land, thus removing their ability to thrive in city-like terrains or any other urban sprawls.

In essence, if successful, *Rhus Integrifolia* has the ability to remove vast amount of carbon dioxide from the air, and use it to help plants instead of harming humans. This plant possess trait that allows it to flourish lavishly in many type of climate and it would not displace other plants or buildings. Not only would the plant be utilizing the carbon within the soil and promote wildlife, but it also breaks up carbon dioxide into oxygen. As a result, carbon offsets can be created for daily usage and the havoc of carbon emissions could slowly begin reversing.

128. UNDERSTANDING THE CALIFORNIA WATER SHORTAGE AND LOCALIZING THE ISSUE FOR MARLBOROUGH SCHOOL

J.J. Huh. Marlborough School, Department of Natural Sciences, Los Angeles, CA, 90004.

Understanding that water is a diminishing resource, it is critical to research what must be done on a local level to further conserve water. This research project focuses on using Marlborough School as a microcosm of Los Angeles and discovering how any institution can use and conserve water. The first step to the research involved conducting a water audit of the school by comparing the water bills before the school started construction and after the school built a LEED-certified building, and examining where

water is used in the school facilities. For the soccer field, water use varied seasonally, but for the rest of the school campus, there was no definitive trend. Along with the water audit, the project also focused on possible behavioral and engineering changes to reduce and reuse water. By taking these first steps, the project aims to address the big question: how can we, as members of the school community, increase use and reuse of local water, ultimately reducing the school's carbon footprint and increasing sustainability?

129. DYNAMICS OF FECAL INDICATOR AND OTHER BACTERIA DURING VARYING TIDAL CONDITIONS IN DEL REY LAGOON, PLAYA DEL REY, CALIFORNIA

J.J. Huh, J.T. Valdez, and J. Dorsey. Leonetti-O'Connell Honors Research in Science, Loyola Marymount University and Marlborough School, Department of Natural Sciences, Los Angeles, CA, 90015 and 90004.

The primary focus of the project was to understand the dynamics of fecal indicator bacteria (FIB), in Del Rey Lagoon, Playa Del Rey, Los Angeles, California, during ebb and flood tides. FIB are categorized into three groups: total coliforms, *E. coli*, and enterococci. To approach the project's focus, different tidal ranges were regressed with respect to the ratio of the mean FIB density between flood and ebb tides. This analysis helped to determine whether the lagoon was a sink or a source of bacteria. The lagoon was a source during spring tides and a sink during neap tides. Another regression analysis between the turbidity and the FIB density showed a strong correlation between the increase of turbidity and the increase of enterococci during periods of low spring tides. Culturable species, which included FIB and non-FIB species, were identified to see the diversity in the different water flows of ebb and flood tides. About 53 species were identified, and the dominant species was *Escherichia coli* during flood and ebb tides. The second most identified species were *Vibrio cholerae* during flood tides and *Enterococcus casseliflavus* during ebb tides.

130. IMPROVING ELEVATOR SCHEDULING EFFICIENCY BY IMPLEMENTING A SMARTER CONTROLLER

Kenny Lei. Walnut High School, 400 N. Pierre Road, Walnut, CA 91789. California State Polytechnic University, Pomona, 3801 W. Temple Avenue, Pomona, CA 91768.

This research considers how efficiently elevators in tall buildings can deliver passengers to their intended destinations. The director behind this process is the elevator controller, which evaluates many possible delivery scenarios and decides the most efficient plan. The problem is relatively simple when the scale of operation is small, but as the number of floors and elevator cars increases, the number of possible plans grows tremendously. This project's objective is to create a smarter elevator controller designed to reduce the average waiting time (AWT), based on the Empty the System Algorithm (ESA), which calculates and minimizes expected waiting times over all passengers using a system of elevators. Due to the complex and costly nature of using and testing real elevator systems, this controller was implemented in an elevator simulator program. Software was developed by integrating the smarter controller into an existing simulator called ElevatorSim, which was written in the Java programming language. The smarter controller was written with five Java methods expected by the simulator. The most important Java method computes for the best car for each car request using an AWT formula created in this project. Over 10,000 elevator simulation trials were performed with ElevatorSim, and the AWT for the smarter controller was compared against the AWT for ElevatorSim's default controller. Observations show that the smarter elevator controller outperforms ElevatorSim's default controller by an average of 12 percent, significantly reducing passenger waiting time. This smarter controller can be applied to real elevator systems and improve elevator efficiency.

131. AN INVESTIGATION OF RADIOISOTOPES AND E.COLI LEVELS IN SANTA MONICA BEACH

A.R. Kelleghan. Notre Dame Academy, Los Angeles, CA and University of Southern California, Los Angeles, CA.

This project was conducted to investigate the residence time of water along the beach and how the bacterial contamination is distributed due to water flux. Shoreline water and pore water from Santa Monica beach were sampled and the presence of radium, E.coli bacteria, and the salinity were examined. Water samples were collected at four points along the Santa Monica Beach during dry and wet weather. At the times that water flowed out of the storm drain, a water sample was collected at that location as well. Water samples were filtered through a radium cartridge and then analyzed on the RaDeCC counter for the presence of ^{223}Ra and ^{224}Ra. Water samples were also taken to measure salinity and the presence of coliform bacteria. Radium has been used as an indicator of water circulation. Larger amounts of ^{223}Ra and ^{224}Ra were found in the pore water than in the water column. The radium concentration in the pore waters was used to calculate the residence time of pore water in the sand before exchange with the shoreline waters. The results indicated that the residence time, averaging 0.4 to 1.7 days, is relatively short. High levels of E.coli bacteria in shoreline waters were correlated with rainfall. Without any rainfall, E.coli bacteria were not found in any of the water samples; however, bacteria were found in every sample during the rainy sampling periods. E.coli bacteria were found only in the water column, not in any of the pore water samples. It appears that groundwater flow through the pore water zone is not a major source of E. coli bacteria in the shoreline water.

132. MAPPING FIFTY YEARS OF VEGETATION CHANGE AT PORTUGUESE BEND

M.H. Ferris. California State University, Long Beach, Department of Geography, Long Beach, California 90840.

Coastal sage scrub (CSS) vegetation communities on the Palos Verdes Peninsula have experienced immense degradation as a result of human conversion of the habitat for agriculture, and later urban uses. While there are some parts of the Portuguese Bend area of the peninsula that have remained untouched, much of the area has experienced disturbances of some type. Due to environmental factors and the desire of the surrounding residents most of the area is undeveloped and many of the previously altered areas have been allowed to revert back to a more "natural" state. The unique history of the site presents a number of opportunities to better understand how CSS and the associated vegetation communities have responded to disturbance. Similar studies in the past have used data from two to three separate time periods to measure changes but the temporal resolution of these studies raised questions and created uncertainty about the changes occurring during the periods between the data sets. This study uses six data sets of historical aerial imagery covering the period between 1956 and 2006 to quantify the changes in vegetation. Image segmentation and object-based feature extraction is utilized to classify and extract vegetation groups. Derived vegetation layers are compared to the previous time period to track changes. Understanding these changes can help inform conservation and restoration efforts.

133. LOOKING BACK AT CHANGES IN COASTAL SAGE SCRUB BOUNDARIES IN THE SANTA MONICA MOUNTAINS, AGAIN

Scott Eckardt, Samantha Roth, and Paul Laris. California State University, Long Beach, Department of Geography, Long Beach, California 90840.

The distribution of coastal sage scrub (CSS) vegetation in Southern California is strongly influenced by local disturbance regimes. While the short term impacts of many disturbances are obvious, long term effects are much more difficult to understand. Responses to some forms of disturbance may be gradual and linear, while others are not. As such, understanding the responses of some vegetation forms to disturbances requires long term observation. In this study, we return to a subset of one such long term study 20 years later. Much can be learned by returning to study sites of previous works by extending the time period and adding new data sources. We focus on CSS stand boundary shifts over time in the Cheseboro and Palo Comado Canyons of the Santa Monica Mountains to asses the influences of wildfire frequency and return interval on changes observed in multiple historical aerial photograph sets. We utilize fire perimeter data and field data to evaluate vegetation cover change over two distinct time periods: 1929–1976 and 1976–2003. Our results support the findings of Freudenberger et al 1987 in that we also observed dramatic CSS coverage loss in portions of the study area. The most dramatic losses occurred in the first half of the 20th century when fire frequency was relatively low while grazing pressure was high. In spite of

the cessation of grazing in the area over 20 years ago, CSS stands have not returned. Correlations between recent CSS/grassland boundary fluctuations and fire frequency were also inconclusive.

134. AN 80 YEAR RECORD OF THE DISTURBANCE REGIME OF CALIFORNIA COASTAL SAGE SCRUB ON THE PALOS VERDES PENINSULA

Jade Dean*, Paul Laris, Chrys Rodrigue, and Michael Ferris. California State University, Long Beach, Department of Geography, Long Beach, California 90840.

California Coastal Sage Scrub (CSS) is one of the world's most threatened habitats. Much of the remaining CSS habitat is degraded due to a variety of human disturbances. It is well documented that at least three disturbances are responsible for the decline of Coastal Sage Scrub and the subsequent invasion of nonnative grasses and forbs; these are grazing, fire, and nitrogen deposition. High fire frequency, intensive livestock grazing, and high levels of nitrogen deposition favor invasive annuals over native CSS. The objective of this study was to investigate the long term impacts of a fourth disturbance, mechanical plowing (or disking) on the Palos Verdes Peninsula. The study combined field study with a series orthorectified images dating from the 1920s to the 2000s to determine the long term effects of mechanical disturbance and fire on CSS cover. Our findings indicate that mechanical disturbances have long lasting impacts. Data suggest that CSS stands to not recover in sites that are mechanically disturbed even if disturbance occurred over 80 years ago. The results also indicate that mechanical disturbances, such as disking, were conducted on very steep slopes and not simply on the flat lands as has often been assumed.

135. REVISITING THE LONG TERM IMPACTS OF MECHANICAL DISTURBANCES, GRAZING AND FIRE ON CSS/GRASSLAND BOUNDARIES IN MUGU STATE PARK, CALIFORNIA

Kyra Engelberg[1]*, Paul Laris[1], and Samantha Roth[1]. [1]University of California, Long Beach.

Grassland/shrubland boundaries in southern California are thought to be influenced by many factors, both natural and anthropogenic. While certain generalizations have been made, such as grasses favoring valley floors with coastal sage scrub (CSS) occupying the slopes, such rules do not apply everywhere. The fact that these two vegetation communities can exist in areas that are environmentally similar points to human influence. Additionally, historical land use was also influenced by the physical environment (e.g., topography, soil), further confounding efforts to determine the causes of vegetation patterns. This study re-examines research completed in 1980 on the CSS/grassland boundaries in two valleys in Mugu State Park. The original study revealed that environmental factors alone could not explain the CSS/grassland boundaries, and concluded that historical ranching and farming were to blame. The original author argued that once the grassland was released from these anthropogenic activities, shrubs would rapidly recolonize the area. This current study retests these earlier findings by extending the study to the present using remotely sensed data from 1976 to 2007 to determine the rate of shrub re-establishment in the absence of grazing. We consider the impacts of four variables: fire regime, mechanical disturbance, farming, and grazing to shed light on the factors governing the grassland/shrubland boundary.

136. REVISITING LONG-TERM STUDIES OF GRASSLAND/WOODLAND BOUNDARIES: WHAT WE CAN LEARN?

Paul Laris. CSU Long Beach.

Understanding the factors that influence the boundaries between woody and herbaceous vegetation has long puzzled ecologists and biogeographers. In many semi-arid environments, from the savannas of Africa to the coastal shrubland communities of California, grassy and woody vegetation forms co-exist on the landscape. In some instances these two vegetation types form distinct homogeneous patches where one form or the other dominates, creating sharp boundaries on the landscape, while in others the two forms co-mingle creating a very heterogeneous mosaic. Research has shown that many factors can influence both the boundary and ratio of woody to grassy vegetation including soil type, topography, climate, grazing, fire regime and mechanical disturbance. Numerous studies have been conducted over the past 50 years

attempting to determine the influences of these key factors. Some of these involve field study whereby disturbance regimes are artificially manipulated. Others involve natural experiments where researchers study the impacts of disturbances after the fact. New data sources, including remotely sensed imagery and fire data sets, make it possible to revisit some of these earlier studies, extend their time-frames and reevaluate the results. This study synthesizes results from long term studies conducted in two semi-arid regions— Coastal California and West Africa. It uses a combination of long-term data sets on mechanical disturbances, fire regimes, grazing and vegetation cover change generated from remotely sensed imagery, field studies and interviews in an attempt to shed light on vegetation dynamics.

INSTRUCTIONS FOR AUTHORS

The BULLETIN is published three times each year (April, August, and December) and includes articles in English in any field of science with **an emphasis on the southern California area**. Manuscripts submitted for publication should contain results of original research, embrace sound principles of scientific investigation, and present data in a clear and concise manner. The current AIBS *Style Manual for Biological Journals* is recommended as a guide for contributors. Consult also recent issues of the BULLETIN.

MANUSCRIPT PREPARATION

The author should submit at least two additional copies with the original, on 8½ × 11 opaque, nonerasable paper, double spacing the entire manuscript. Do not break words at right-hand margin anywhere in the manuscript. Footnotes should be avoided. **Manuscripts which do not conform to the style of the BULLETIN will be returned to the author.**

An abstract summarizing in concise terms the methods, findings, and implications discussed in the paper *must* accompany a *feature article. Abstract should not exceed 100 words.*

A feature article comprises approximately five to thirty typewritten pages. Papers should usually be divided into the following sections: abstract, introduction, methods, results, discussion and conclusions, acknowledgments, literature cited, tables, figure legend page, and figures. Avoid using more than two levels of subheadings.

A research note is usually one to six typewritten pages and rarely utilizes subheadings. Consult a recent issue of the BULLETIN for the format of *notes*. Abstracts are not used for notes.

Abbreviations: Use of abbreviations and symbols can be determined by inspection of a recent issue of the BULLETIN. **Omit periods after standard abbreviations:** 1.2 mm, 2 km, 30 cm, but Figs. 1–2. Use numerals *before* units of measurements: 5 ml, but nine spines (10 or numbers above, such as 13 spines). The metric system of weights and measurements should be used wherever possible.

Taxonomic procedures: Authors are advised to adhere to the taxonomic procedures as outlined in the International Code of Botanical Nomenclature (Lawjouw et al. 1956), the International Code of Nomenclature of Bacteria and Viruses (Buchanan et al. 1958), and the International Code of Zoological Nomenclature (Ride et al. 1985). Special attention should be given to the description of new taxa, designation of holotype, etc. Reference to new taxa in titles and abstracts should be avoided.

The literature cited: Entries for books and articles should take these forms.

McWilliams, K. L. 1970. Insect mimicry. Academic Press, vii+326 pp.

Holmes, T. Jr., and S. Speak.1971.Reproductive biology of Myotis lucifugus. J. Mamm., 54:452–458.

Brattstrom, B. H.1969.The Condor in California. Pp. 369–382 in Vertebrates of California. (S. E. Payne, ed.), Univ. California Press, xii+635 pp.

Tables should not repeat data in figures *(line drawings, graphs, or black and white photographs) or contained in the text.* The author must provide numbers and short legends for tables and figures and place reference to each of them in the text. Each table with legend must be on a separate sheet of paper. All figure legends should be placed together on a separate sheet. **Illustrations and lettering thereon should be of sufficient size and clarity to permit reduction to standard page size;** *ordinarily they* **should not exceed 8½ by 11 inches** in size and after final reduction lettering must equal or exceed the size of the typeset. All half-tone illustrations will have light screen (grey) backgrounds. Special handling such as dropout half-tones, special screens, etc., must be requested by and will be charged to authors. **As changes may be required after review, the authors should retain the original figures in their files until acceptance of the manuscript for publication.**

Assemble the manuscript as follows: cover page (with title, authors' names and addresses), abstract, introduction, methods, results, discussion, acknowledgements, literature cited, appendices, tables, figure legends, and figures.

A cover illustration pertaining to an article in the issue or one of general scientific interest will be printed on the cover of each issue. Such illustrations along with a brief caption should be sent to the Editor for review.

PROCEDURE

All manuscripts should be submitted to the Editor, Daniel J. Pondella II, Moore Laboratory of Zoology, Occidental College, 1600 Campus Rd., Los Angeles, CA 90041. Manuscripts may be submitted by mail, or by e-mail to pondella@oxy.edu as a Word document. **Authors are requested to submit the names, addresses and specialities of three persons who are capable of reviewing the manuscript. Evaluation of a paper** submitted to the BULLETIN begins with a critical reading by the Editor; several referees also check the paper for scientific content, originality, and clarity of presentation. Judgments as to the acceptability of the paper and suggestions for enhancing it are sent to the author at which time he or she may be requested to rework portions of the paper considering these recommendations. The paper then is resubmitted on disk in word format and may be re-evaluated before final acceptance.

Proof: The galley proof and manuscript, as well as reprint order blanks, will be sent to the author. He or she should **promptly** and **carefully read** the proof sheets for errors and omissions in text, tables, illustrations, legends, and bibliographical references. He or she marks corrections on the galley (copy editing and proof procedures in *Style Manual*) and **promptly returns both galley and manuscript** to the Editor. Manuscripts and original illustrations will not be returned unless requested at this time. **All changes in galley proof attributable to the author (misspellings, inconsistent abbreviations, deviations from style, etc.) will be charged to the author. Reprint orders are placed with the printer, not the *Editor*.**

SMITHSONIAN INSTITUTION LIBRARIES
3 9088 01557 2381

CONTENTS

Notes on the Breeding Biology of the White-Throated Swift in Southern California. Charles T. Collins 23

Occurrence of the Barnacle (*Xenobalanus globicipitis*) on Coastal and Offshore Common Bottlenose Dolphins (*Tursiops truncatus*) in Santa Monica Bay and Adjacent Areas, California. Maddalena Bearzi and Katalin Patonai 37

Annual Meeting of the Southern California Academy of Sciences 45

Future Meetings 46

Acknowledgements of Sponsors 46

Annual Grant Award Winners 46

Best Paper and Poster Awards 47

Alphabetical list of Presenters at 2010 Annual Meeting 49

Overview of the Meeting 52

Schedule of Program for 2010 Annual Meeting 53

Abstracts for 2010 Annual Meeting, in Program Order 68

Cover: Adult White-throated Swift carrying a bolus of nestling food. Photo by Kevin Smith, reproduced by permission.